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## CONTRIBUTORS TO THIS NUMBER

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- J. DELLINGER HARVEY, M. D., Chief of Urology, Genito-urinary Department, Massachusetts General Hospital, Instructor in Genito-urinary Surgery, Harvard Medical School.
- JOHN T. BOTTOMLEY, M. D., Chief Surgeon, Carney Hospital.
- FREDERIC J. COTTON, M. D., Associate in Surgery and Instructor in Industrial Surgery, Harvard Graduate School of Medicine; Visiting Surgeon, Boston City Hospital.
- ELLIOTT C. CUTLER, M. D., Associate Surgeon, Peter Bent Brigham Hospital, Instructor in Surgery, Harvard Medical School.
- LINCOLN DAVIS, M. D., Visiting Surgeon to the Massachusetts General Hospital.
- WILLIAM PHILLIPS GRAVES, M. D., Professor in Gynecology, Harvard Medical School; Surgeon-in-Chief, the Hospital for Women, Brookline; Consulting Gynecologist, Boston Lying-in Hospital.
- TORR WAGNER HARNER, M. D., Assistant in Anesthetics and in Surgery, Harvard Medical School, Associate in Surgery, Harvard Graduate School of Medicine, Assistant to Out Patients, Massachusetts General Hospital.
- DANIEL FINEE JONES, M. D., Visiting Surgeon, Massachusetts General Hospital, Associate in Surgery, Courses for Graduates, Harvard Medical School.
- FRANK H. LAHEY, M. D., Professor of Surgery, Tufts College Medical School, Visiting Surgeon, Boston City Hospital.
- W. RUSSELL G. MACAULAND, M. D., Surgeon-in-Chief, Orthopedic Department, Carney Hospital.
- WILLIAM C. QUINBY, M. D., Urologist, Peter Bent Brigham Hospital, Assistant Professor of Genito-urinary Surgery, Harvard Medical School.
- EDWARD P. RICHARDSON, M. D., Assistant Visiting Surgeon, Massachusetts General Hospital.
- WILLIAM M. SHEDDEN, M. D., formerly Resident Surgeon, Genito-urinary Department, Massachusetts General Hospital.
- JUDSON A. SMITH, M. D., Assistant Resident Surgeon, Peter Bent Brigham Hospital.
- WYMAN WHITTEMORE, M. D., Assistant in Surgery, Courses for Graduates, Harvard Medical School; Assistant Visiting Surgeon, Massachusetts General Hospital, Visiting Surgeon, Beth Israel Hospital, Consulting Surgeon, Massachusetts General Hospital; Consulting Surgeon, Mount Memorial Hospital, Asheville.
- IRVING J. WALKER, M. D., First Assistant Visiting Surgeon, Boston City Hospital, Assistant in Surgery, Courses for Graduates, Harvard Medical School.

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# THE SURGICAL CLINICS OF NORTH AMERICA

Volume 2

Number 4

CLINIC OF DR. WILLIAM P. GRAVES

FREE HOSPITAL FOR WOMEN

## GYNECOLOGIC CASES

DR. GRAVES The first patient, Mrs. F. is thirty five years old. She has had 3 children and 3 miscarriages. About a year and a half ago I performed a supravaginal hysterectomy on her.

Her health was much improved by the operation and she has felt very well until about a month ago when she began to have severe pain in the epigastrium, with indigestion and loss of appetite. Although her symptoms do not point to any pelvic trouble, we will first examine her to determine the local result of her operation. I find on bimanual examination, a small indurated smooth mass just to the left of and posterior to the cervical stump. It is somewhat smaller than an English walnut. Can you feel what I describe?

MR. M. Yes.

DR. GRAVES This is somewhat surprising and we will consult her history to find if possible some explanation for it. On looking over her hospital record we find it stated in the discharge note that there is on the left side a parametrial hematoma. The case therefore is interesting from a gynecologic standpoint, for it illustrates well the occurrence and fate of the postoperative cellular hematomas that occasionally follow hysterectomy. The collection of blood, as a course, due to the incomplete or insecure tying of small vessels in the parametrium, as a rule it does no serious harm. The blood goes out into a confined space in

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filtrates the cellular space to a greater or less degree becomes clotted and then gradually organizes. The result is an indurated area of extraordinary hardness. It is usually localized to one side of or in front of the cervix, though in severe cases it may entirely surround it, so that the entire floor of the pelvis is like a board. It may take months for the mass to absorb as may be seen in this case before you in which it has not disappeared at the end of nearly a year and a half. As a rule there are few if any symptoms. On two or three occasions in our experience there has been not long after the operation, a temporary period of rapid pulse and mild shock unaccounted for at the time but explained later by finding the indurated mass in the pelvis. Sometimes there is a slight, dull, localized pain. There is apt to be a moderate daily rise of temperature occasionally lasting for several weeks.

In rare instances the hematomas become infected and turn into troublesome pelvic abscesses that have to be opened from below through a vaginal incision.

The usual treatment for parametrial hematoma is frequent hot douching.

The occurrence of parametrial hematomata after hysterectomy must be regarded as the result of faulty technic. They are far less common than formerly for at the present time supra-vaginal hysterectomy is one of the best organized of abdominal operations. The condition is especially impressed on my mind because the most severe external case that I have ever seen occurred after my first hysterectomy many years ago. The entire floor of the pelvis was involved and was so densely hard that I felt quite certain that it must be a rapidly growing peritoneal sarcoma or something like that. The true pathologic condition of the mass was further impressed on my mind by the fact that my superior officer insisted that an acute infection was present and that the mass should be incised and drained. He therefore made several vaginal punctures into the heart of the indurated mass, but in each instance produced nothing but a small amount of dark blood. The patient eventually got well but the induration did not disappear for more than a year.

To return to the case before us, we may rule out the pelvis as being the source of her present trouble. In looking again through her record we find that at the time of the operation I made a note that there was a general visceroptosis, including the liver and kidneys. I also stated that I could feel no stones in the gall-bladder. As the case, therefore, is not strictly a gynecologic one, we will not discuss it further but will turn the patient over to an internist for diagnosis and treatment.

The next patient, Mrs. M. age fifty-seven, has never had children. She has the somewhat odd complaint of dyspareunia and continual pains in the left lower back, running down the left leg. If you will examine the patient you will observe a marked condition of genital atrophy. The introitus is very tight and inelastic, the vagina is small, narrow and conical in form. The cervix is flattened out and insignificant, while the uterus is so small it cannot be felt. There is nothing in the pelvis to account for the aches in the back and leg. If we have the patient stand you will observe that she is fat and flabby and that she has a marked pronation of the ankles especially on the left. We will discuss this case in the other room.

The general aspect of this woman's pelvis leads one to suspect that she at no time in her life ever had a very bountiful genital endowment. The fact that she never had children supports our suspicion. Abnormal genital atrophy, in my opinion, is an individual idiosyncrasy the cause of it being due probably to an insufficiency of some part or parts of the endocrine system. One sometimes encounters it after a hysterectomy and ablation of the ovaries and this occurrence though very infrequent, is used as an important argument by the ovarian conservationists. Abnormal genital atrophy may lead to distressing symptoms other than dyspareunia. The tight, unyielding perineal opening sometimes acts as a partial obstruction to the secretions so that they become dammed back as it were and irritate the thin sensitive vaginal lining, producing the condition of so-called senile vaginitis. This may result in plastic adhesions of the vagina accompanied by uncomfortable leukorrheal discharges, often



stained with blood. The irritation extends to the external parts and may lead to such unendurable afflictions as pruritus and kraurosis vulvae.

If this patient were suffering from these sequelae or if we were convinced that the dyspareunia were a very serious present factor we should recommend a perineoplastic operation to enlarge the introitus. This consists merely in an artificial relaxation of the parts by dissection. Usually the constriction is only in the skin and underlying connective tissue. The muscle tissue only rarely requires incision. In elderly patients it is advisable to keep a glass plug in the vagina during the process of healing.

*In this particular case I doubt if the vaginal condition requires surgical treatment. You have doubtless noted from the patient's conversation and actions on the table that she is extremely neurotic. If we were neurologists we should suspect some sort of a Freudian complex. Psycho-analysis would very likely reveal that this woman has always suffered from dyspareunia and that her sexual incompetence has served as the basis of a functional neurosis. The pain in her back and leg is, without question a static trouble resulting from overweight weak feet and lack of muscular tone. She however has referred it to the genital abnormality which has long preyed on her mind. We shall therefore defer the question of operation at least for the present, and shall recommend orthopedic treatment and moderate reduction of fat.*

Mrs. I. age forty nine has a history of menorrhagia for the last few months without other symptoms. She had a miscarriage twenty-six years ago her only pregnancy. Is there anything particularly noticeable about the patient's general appearance? M. Hagstrom?

Mr. H. She looks pale. I should think she had anemia.

DR. GRAVES. Yes, she is pale and is probably anemic but there is in the appearance of the skin of her face and abdomen something besides paleness that is hard to describe. 'Cachectic' is too strong a word to apply in this case but there is at least suggestion of cachexia. The external genitals also have a dead

colorless look which though not pathognomonic of malignant disease nevertheless lead one immediately to think of it. Mr Loring what do you find on examination of this patient?

MR. L. I feel a hard mass in the pelvis.

DR. GRAVES Do you agree to that, Mr McLeod?

MR. M. I feel a hard mass, and I think I can feel the uterus in front of it and a little to the right.

DR. GRAVES Describe the mass a little more in detail.

MR. M. I feel it clear across the pelvis. It is like a wall. Its surface is rather irregular. The uterus in front seems to be absolutely fixed.

DR. GRAVES Can you feel any mass with your abdominal hand?

MR. M. No sir.

DR. GRAVES What do you think it is?

MR. M. I don't know but I think it feels like a malignant growth.

DR. GRAVES I quite agree with you. The diagnosis is doubtful, although most of the evidence points toward malignancy. One would think of cancer of the uterine body with extension through the peritoneum of the posterior culdesac, possibly an adherent ovarian cancer. On the other hand an old pelvic inflammation cannot entirely be ruled out. What shall we do for the patient?

MR. M. You might use radium.

DR. GRAVES What do you say Mr Hagstrom?

MR. H. I should not use radium because there is too much chance that there may be an inflammatory process, in which case radium would be very dangerous. I think it would be best to make an exploratory incision.

DR. GRAVES I agree with you. It is impossible to make a diagnosis at present. We will make under ether a careful vaginal and intra-uterine examination and then if necessary or if we are still in doubt of the diagnosis open the abdomen and let our course be determined by what we find.

(Later operation disclosed an extensive old pelvic inflammation undergoing an acute purulent recrudescence.)

The next patient, Mrs. N., is sixty-six years old. She had two miscarriages many years ago but never a full-term child. She complains of frequent desire to urinate especially when on her feet, and a continuous sense of pelvic pressure which she describes as a bearing-down feeling. Please examine her M. Loring, and tell me what you find.

MR. L. I cannot feel the fundus of the uterus. The cervix comes well down in the vagina almost to the perineum. There is quite a large cystocele.

DR. GRAVES Yes. This is a case of general prolapse in a woman who has never borne children at full term. It is not uncommon and is sometimes seen even in women who have never married. The prolapse may occur as early as the age of thirty-five and is probably due to some inherent insufficiency of tone in the supporting structures of the pelvic organs. In this case it may be due to abnormal atrophy of the parts. In the average case a reconstructive operation is indicated. This patient however is sixty-six years of age and not very rugged looking at that. We should, therefore, prefer not to operate on her if we can avoid it. In elderly women we use pessaries a great deal if it is found possible to support the prolapsed tissues by such measures. We shall try the pessary treatment in this case but I have some doubts as to its success, for as you see, the vagina has lost something of its attachment to the pubic rami. In such a vagina it is difficult to fit a pessary that will stay. The best form of pessary to use in a case of this kind is the copper-cored rubber ring which can be bent into any desirable shape. These pessaries lack the undesirable stiffness of the hard-rubber variety. They can be kept clean and are far superior to the soft rubber doughnut type which invariably produces a foul leukorrheal discharge.

If in this case pessary treatment is unsatisfactory as it is likely to be the question of operation must be decided. A careful physical examination will be made and if the patient's general health warrants it, an operation will be advised, to consist of a rapid vaginal repair of the cystocele and a suspension of the uterus by the modified Ohlhausen method. The slight

risk that this operation entails is of course somewhat increased by the patient's age but the taking of this extra risk is justifiable for if nothing is done for the patient the prolapse is sure to become worse as the patient grows older. The final outcome is fairly certain to be a proctentia and a more or less complete incapacitation of the patient in her old age.

Mrs. J. is forty three years of age. She has been married ten years and has a child nine years old. She complains of dysmenorrhea, pains in the whole of the back, and especially in the back of the neck and headaches. How bad is the pain at your periods, Mrs. J.?

PATIENT It's awful bad, doctor. It's so bad that my doctor makes me take morphin, but I don't think he ought to.

DR. GRAVES How long have you had these troubles?

PATIENT Twenty years ever since I fell off a car.

PATIENT Do you think the fall gave you some womb trouble?

PATIENT Yes, doctor. It started a dark brown discharge that I have had ever since. I have had to wear a napkin ever since the accident.

DR. GRAVES Was there a law suit?

PATIENT Yes, doctor.

DR. GRAVES Was the suit settled?

PATIENT Yes, doctor.

DR. GRAVES Have you any other troubles?

PATIENT I was operated on two years ago. They sewed up my womb and took out my appendix. But I don't think they did a good job because I haven't felt well since.

DR. GRAVES I think I will not have you examine this patient gentlemen. I find the uterus in excellent position and the pelvis entirely negative. We will discuss the case in the other room. It is necessary to handle this patient with some care. She has a rather threatening ugly air about her. From her general appearance and from what she says about her doctor's making her take morphin, the suspicion that she is a drug addict is unavoidable. However we must try to do something for her. We will have the head nurse have a quiet, kindly talk with her.

The next patient, Mrs. N. is sixty-six years old. She had two miscarriages many years ago but never a full-term child. She complains of frequent desire to urinate, especially when on her feet, and a continuous sense of pelvic pressure which she describes as a bearing-down feeling. Please examine her Mr. Loring, and tell me what you find.

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DR. GRAVES Yes, the diagnosis is so obviously that of a fibroid that it needs no further discussion and we will go on to the next case

(Operation two days after Abdomen has been opened by long incision) This, gentlemen, is the case that we all agreed day before yesterday was a large fibroid. You now see the tumor exposed to view Do you notice anything peculiar about it, Mr McLeod?

MR. M It looks too white for a fibroid. Fibroids are more purplish in color

DR. GRAVES Fibroids are sometimes white when they are calcified or if they are extremely fibrous. As we examine this tumor more minutely we find the broad ligament and fallopian tube stretched across the front of it. It is very adherent, but as I release the adhesions I can feel the normal body of the uterus pushed over to the left. As I deliver the mass it is seen to be a conglomerate tumor of the right ovary The uterus is quite normal. There is a smaller tumor of the left ovary As I pass around the specimen you will note that the tumor on the right is a large fibroma, on the surface of which are several thin walled cysts and papillomatous excrescences. The tumor on the left is a multilocular cystoma to which is attached a large hydrosalpinx. The pathologic report of this heterogeneous neoplasm will be interesting

(The pathologic examination of this specimen revealed the unusual combination in one ovary of a large fibroma and a malignant papillary cystadenoma. The small tumor of the other ovary showed a similar papillary growth, also malignant. On the back of the uterus which was otherwise normal, was a small implant from the carcinomatous cyst. There were also large hydrosalpinges.)

This young woman, Miss O'D is sixteen years old. She started to menstruate at the age of fourteen and flowed normally for about a year Last May the periods began to be prolonged and since then there have been only short intervals when she has not been bleeding You will note that the vulva is stained with

and try to get a more coherent story of her ailments than we have so far been able to secure. If the dysmenorrhea is as bad as she says it is, it is justifiable to stop the menses with radium. Before taking any such step in this case, it is necessary to be perfectly sure of one's ground and to have a complete understanding with the patient and her husband.

What do you think, Mr. McLeod, of the story of a dark brown vaginal discharge caused by a fall from a street car and lasting twenty years?

MR. M. It doesn't seem reasonable to me.

DR. GRAVES. Yet it is no more absurd than many claims of pelvic injuries that are made daily in the courts. I have on several occasions seen substantial damages recovered by women suffering from pelvic inflammatory disease, whose lawyers and doctors claimed that the inflammation was caused by a fall from a street car or a slip on the ice.

This patient, Mrs. K., is fifty-five years of age, and has had 6 children. Her periods ceased eight months ago. Of late she has been having more or less pain in both sides, and thinks she is growing larger. You see the patient is thin, meager, with a large protruding tumor of the abdomen.

Will you palpate the abdomen, Mr. Hagstrom, and tell me what you find?

MR. H. I find a large mass extending above the umbilicus. There seem to be other masses on the sides, especially on the right. The tumor is very hard and immovable. There is some tenderness on the sides.

DR. GRAVES. Mr. Loring, will you make a vaginal examination and tell me what you find?

MR. L. I can feel the tumor extending down into the pelvis on the right side. When I press the mass with my outside hand, I can feel the motion communicated to my fingers on the cervix.

DR. GRAVES. Which leads you to conclude that—

MR. L. The mass is connected with the uterus.

DR. GRAVES. And your diagnosis is—

MR. L. Fibroid.

STUDENT If worse comes to worse you could curet, and if that doesn't work you could castrate her

DR. GRAVES Can't you think of something simpler than that?

STUDENT Well, you might give her radium but you would be likely to sterilize her

DR. GRAVES We are using radium almost entirely now for these cases, and apparently without danger of sterilizing them. As a matter of fact, it is harder to stop the menses in a girl of this age than it is in a middle-aged woman. When we first began treating them we were overcautious and gave too small a dose so that it had to be repeated once or twice. We are now giving to a patient of this kind 50 mgm. for four to six hours, depending on the development of the patient and the severity of the bleeding. In none of our cases so far has there been a permanent cessation of catamenia.

The next patient, Mrs. H. wishes to have children. She has been married nine months. Since a short time after her marriage she has had a continuous leukorrhoea and a low backache, which is becoming more severe. You will notice when you examine her that the uterus is in complete retroversion-flexion. It is impossible to restore it to position. On the back of the uterus can be felt a lump which strongly suggests an adherent tube and ovary. What condition have we here Mr. Hagstrom?

MR. H. Chronic adhesive pelvic inflammation of a gonorrhoeal origin, and endocervicitis from the same cause.

DR. GRAVES Probably. What shall we do for her?

MR. H. You might inflate the tubes with CO<sub>2</sub> to see if they are patent.

DR. GRAVES I don't think you would gain much by that. Even if you found them open, you would still have your retroflexion and endocervicitis. I should advise operation in this case. The first step in the operation would be to cauterize the endocervix by making deep radiating gashes into the mucous membrane with the thin edge of an electric cautery. The next step would be to open the abdomen and perform a conservative operation on the adherent adnexa. There is probably plenty of ovarian



blood, giving the impression that the loss of blood has been considerable. The patient is pale and obviously anemic. In making a vaginal examination we notice first that the nymphæ are unusually large and pendent. The hymen is unruptured, but admits the examining finger. Bimanual examination shows the uterus to be very large and in the position of extreme retroflexion. One of you may examine the patient by rectum. What do you find?

STUDENT I feel a big mass.

DR. GRAVES The uterus feels very much larger through the rectum than it does through the vagina. The fundus of a large retroflexed uterus feels per rectum like a pelvic tumor. Even the cervix feels astonishingly large when palpated by the rectal route. (To intern You may be getting the next case ready.)

What is the cause of this girl's bleeding?

STUDENT Uterine insufficiency.

DR. GRAVES Yes, but that describes a condition. Is there any known cause for the "insufficiency"?

The real cause it must be admitted, is not known. We have another case in the hospital, only fourteen years old, in whom there is an even more marked genital development than in this patient. In most of the cases that I have seen there has been an evident precocity both of the primary and secondary sexual characters, and in most of the cases there is some evidence of sexual hypersensibility. In this case for example the appearance of the labia minora strongly suggests masturbation. It is a question whether early sexual practices have induced a precocious genital development, or whether the abnormal development is primary leading to sexual hyperesthesia.

What is the treatment for this case?

STUDENT You might use pituitrin.

STUDENT Or a large dose of corpus luteum.

STUDENT You could try ergot or hamamelis and hydrastis.

STUDENT How about rabbit's blood or calcium lactate or something like that?

DR. GRAVES Any other suggestions?

the tunica albuginea which prevents a rupture of the follicle and discharge of the ovum.

(Operation two days later) This is the case of sterility that you saw day before yesterday in which there was an elongated cervix and sclerotic ovaries. I am performing a low amputation of the cervix by Hegar's method taking great care to approximate the wound edges and to make the new external os as much like nature as possible. On opening the abdomen and bringing the ovaries up to view you see that they are much as I described them except that they are somewhat smaller and less sausage shaped than I predicted. You see that they are smooth and white and that in neither ovary is there a corpus luteum though there is plenty of evidence of follicle atresia. I do not often make a practice of resecting ovaries but in this case I shall take a wedge out of the right ovary and reduce it to normal size. Note that the wedge of ovarian tissue which I remove is denser than normal. I shall also make numerous incisions in the surface of the remaining portion of the ovary. The left ovary I shall treat in the same way except that its size does not require resection. Whether these procedures have any real value in helping the ovum to escape I do not know. Some think it of great importance.

The uterus which we found retroverted is, on bringing it to view rather unpromising. It is smaller than normal and has white patches on the surface that indicate areas where the fibrous elements of the uterine wall predominate over the musculature. This is the reverse of what should exist in the normal child bearing uterus.

We will suspend the uterus by the Ohlshausen method

Mrs. P. thirty-six, married ten years, has never been pregnant. She also comes for sterility. She states that six years ago she was operated on at another hospital, when her appendix and left ovary were removed. Since then she has suffered from a constant leukorrheal discharge. Examination shows the uterus to be in the forward position having probably been fixed to the abdominal wall at the time of the operation. In the left horn

tissue, for there has been no particularly destructive process on the part of the disease. Stomatoplastic operations should be performed on the tubes if possible. If they are hopelessly closed they should be resected from the cornua and ovarian transplants placed in the wounds made by their removal. Raw surfaces should be laboriously covered over and all bleeding entirely stopped. Finally the uterus should be suspended. The operation is a long and tedious one but it is thoroughly worth while for if the tubes are not entirely out of circulation there is a fair chance of restoring fertility.

The next patient, Mrs. E. also wants children. She is only twenty five years old and has been married nine years. She has always suffered from dysmenorrhea since she started to menstruate. Examination shows a long narrow cervix. The uterus is in retroflexion and has a tendency to descend both ovaries can easily be felt. The outlook for curing this patient of sterility by an operation is not particularly good, but operation is thoroughly advisable. It would at least probably help or perhaps cure the dysmenorrhea.

The unfavorable factor in this case as far as the cure of sterility is concerned, is the element of deficient development that is apparent in the genital organs. The long slender cervix that comes nearly to the introitus is itself a bad sign. If left untreated I have no doubt that after a lapse of several years this patient will develop procidentia of the so-called congenital type to which I have already alluded in the case of Mrs. V. when, as you remember I ascribed the cause to an inherent lack of tone in the supporting structures. I propose to amputate this cervix partly with the somewhat forlorn hope of improving its constrictor power and partly to prevent future procidentia. The large hard, easily palpable ovaries are also a stigma of incomplete development. They are doubtless of the so called infantile type. I think when we open the abdomen that we shall find them long, somewhat sausage shaped of pearly white color and with a smooth unscarred surface. The color and smoothness of surface is due to an abnormal thickness and density of

a small cervical polyp half way up the canal. I shall remove it and burn the point of attachment deeply with an electric cautery. The cervix dilates easily. The uterus is very small and flaccid. I shall use the Ferguson stem pessary as it is the easiest to apply and remove, and it is the safest to leave in the uterus. It is placed *in situ* by this convenient applicator and kept in place by this hard rubber vaginal pessary. The stem will be left in for about eight weeks.

The next patient, Mrs. U., is forty-three years old, married eighteen years, and the mother of 3 children. She began to have abnormal bleeding at her periods three years ago and has gradually been getting worse. For three months she has been bleeding most of the time. You will find on examination that the cervix has a stellate tear is large and swollen, and is slightly suspicious to the feel. The uterus is large and boggy and in the position of right lateral version. On the posterior wall of the vagina just back of the cervical tip is a small tumor a little larger than a pea. Can you all feel it?

STUDENT Yes.

DR. GRAVES What do you think of it?

STUDENT It may be a vaginal cyst.

DR. GRAVES Yes, it may be a cyst, and probably is, but it may also be an implantation from a cancer of the uterine body. Such implants are not uncommon. This case may be a cancer of the cervix, cancer of the body or simply a uterine insufficiency. We will prepare the patient for any emergency and have at hand our full supply of 225 mgm. of radium. We shall begin by making an examination under ether. If it proves to be an unmistakable case of cancer of the cervix, we shall operate or give radium, according to our best judgment at the time. If it is an unmistakable cancer of the body we shall operate. If it is plainly a case of uterine insufficiency we shall apply 100 mgm. of radium to the uterine canal for twelve hours. If there is doubt of the diagnosis, we shall remove specimens from the cervix, endocervix, endometrium, remove the small tumor of the vagina and defer further action until the final diagnosis is made by the microscope.

of the uterus is a fibroid about the size of a lime. I intend to operate on this patient also though the chances of success are rather meager. I shall remove the fibroid by a myomectomy and probably perform a stomatoplastic operation on the right tube, which I rather expect to find closed by adhesions. The endocervix should be cauterized in the manner that I have described to you.

Operations for sterility are entirely justifiable when there is a tangible hope of a cure, even though the prospect of success is not bright. Inability to conceive frequently causes in a woman a keen and sometimes a serious mental distress which may often be alleviated by the realization that she has done everything in her power to attain the desired result, even at the risk of her life. She is thus furnished with a kind of defence for the mental despondence arising from sterility is often induced not so much by an innate consciousness of not having fulfilled the natural function of motherhood as by the reproaches, silent or expressed, of an unfeeling or disappointed husband.

The next case Mrs. C. is thirty-four and has been married nine years. She too comes in for sterility. She says she had a dilatation and curetage in 1916 at which time a small cervical polyp was removed. Examination shows a very small, infantile uterus in the usual position of anteversion and retroversion. It is safe to say that this case is well-nigh hopeless. Still it is best to do something for the patient's peace of mind. In this particular instance I am going to do something that I very rarely do namely insert a stem pessary. Sometimes stem pessaries are successful. I once used one in a patient somewhat like this one in type, who became pregnant while the pessary was in the uterus. The objection to the stem is the slight danger of setting up a catarrhal salpingitis. This patient lives near by and can be kept under close observation. I shall also prescribe a course of glandular treatment, beginning with a mixed extract composed of ovarian residue, anterior lobe, and thyroid.

(Operation two days later) This is the case of sterility due to infantile uterus that you saw day before yesterday. There is

If a woman has a prolapse and is suffering from the typical symptoms I do not hesitate to advise operation no matter how young she is. Otherwise she may be obliged to endure unecessarily years of physical incompetence with all the train of nervous and other ailments that prolapse is apt to entail. If there is prolapse without symptoms I do not urge an operation.

In this particular case we shall not wait for the menopause but we recognize that the present moment is not an auspicious time for the operation. In the first place the patient has not weaned her baby. Then, too we know that during the lactation period the genital parts are not in the most favorable condition for plastic surgery. And finally the performance of so extensive an operation as we propose only three months after childbirth is not judicious surgery unless the operation be much more urgent than this one. The patient's symptoms may probably be relieved by a pessary for the time being. Dr McKnight will you please fit a pessary in this woman's vagina and keep good track of it. Tell her to wean her baby in two or three months and come in early in the fall for her operation.

Mrs. D. comes to report after her operation, which was performed four months ago. She had a general prolapse like the patient you have just seen, requiring a general reconstruction. The symptom of which she complained most was long-standing irritating leukorrhea. The cervix was not deeply lacerated but was badly everted and eroded. It was treated with the electric cautery in the manner that I have already described to you. The patient says that she is feeling fine and that the leukorrhea has ceased.

Non-gonorrheal endocervicitis is quite amenable to treatment, as a rule but by no means always so. Chronic gonorrheal endocervicitis is one of the most difficult problems that the gynecologist has to meet. We will discuss that subject at another time.

This patient, Mrs. S. is thirty five years old. She has had 5 children, the last one three months ago. She complains of dragging pains low down on both sides, and says that there is an uncomfortable lump in her front passage. She tires easily when on her feet, and has the general appearance of a hard-working, worn-out woman. She is still nursing her baby.

Your examination shows that she has a diastasis of the abdominal recti muscle. The cervix is deeply lacerated. There is a marked cystocele and a relaxed perineal opening. The uterus prolapses half way down the vagina.

The patient presents most of the mechanical ills of child bearing and exhibits the typical symptoms. She needs a general reconstructive operation, consisting of a repair of the cervix, repair of the prolapsed anterior and posterior walls, reunion of the separated recti muscles, and a proper ventral suspension. In our routine gynecologic work this is the most consistently satisfactory operation that we do and we may come as near guaranteeing a restoration of health to this woman as a surgeon is justified in guaranteeing anything. The question is: When shall we do the operation? The patient herself wishes immediate relief. What do you say, Mr. Loring?

MR. L. I don't see any use in operating on her now. She is likely to have another baby and undo all your work. I should advise waiting until she is through bearing children.

DR. GRAVES. I expected that answer and we will discuss it for a moment. I think you give too little credit to the efficacy of the operation. It is our experience that if a woman has a child after a well-done reconstructive operation the cervix may be lacerated perhaps as badly as before. The cystocele rarely recurs. A properly repaired perineum stands the strain surprisingly well and only in minority of cases needs later operation. The reunited recti may be relied upon to stay put while a uterus suspended by the Ohlshausen method not only does not cause dystocia but only in rare instances is it torn from its moorings by later child bearing. If the patient does need second operation, therefore merely a minor vaginal procedure is required.

## CLINIC OF DR. JOHN T. BOTTOMLEY

### CARNEY HOSPITAL

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**CHOLELITHIASIS. CHOLECYSTECTOMY OPERATIVE INJURY TO THE MAIN BILE-DUCT PRIMARY END-TO-END SUTURE. POSTOPERATIVE STRICTURE OF THE DUCT HEPATICODUODENOSTOMY RECURRENCE OF THE STRICTURE. SECOND HEPATICODUODENOSTOMY OVER RUBBER TUBE.**

A WOMAN forty years of age entered the Carney Hospital August 31 1920. There was nothing unusual in her family history. Three years before her present illness she had experienced an attack of biliary colic. This was of short duration, and after that she had been well up to the time of her present illness, which began three weeks before her coming to the hospital. This last attack had been characterized by the usual colicky pain and by jaundice; chills had been absent; there had been symptoms of some digestive disturbance. At the time of her admission the jaundice had disappeared and her general condition was very good. There was some tenderness beneath the right costal border; the physical examination was otherwise negative.

Operation (September 1 1920). An oblique incision was made through a thick abdominal wall. The kidneys, spleen, stomach, duodenum, and pancreas were normal. A moderate degree of hepatitis was present. The gall bladder was distended and packed full of stones; several small stones were impacted in the cystic duct. The gall-bladder was long and the infundibulum very well marked. Some postgraduate students were present, and I demonstrated the cholecystoduodenal fold and showed very clearly the common and hepatic ducts. The cystic duct was isolated; the cystic artery was easily demonstrated; it was considerably enlarged. I put a hemostat on the cystic duct on account of the small stones impacted in the duct; I had to





then she again became jaundiced and had a return of her former symptoms. There was some mental disturbance also. She was readmitted to the hospital May 11 1922 and was operated on again May 13 1922

The incision followed the line of incision of previous operation. Again numerous dense adhesions were found about the region of the former operation these were carefully separated, until that portion of the duodenum was shown which had been sutured to the liver. By sharp dissection these adhesions of the duodenum to the liver were carefully incised until finally the mass of scar tissue at the point of emergence of the hepatic duct from the liver was disclosed. With a hypodermic needle the thick but somewhat dilated completely closed end of the hepatic duct was identified. Dark colored bile was withdrawn from it. The duodenum was now widely freed from the liver and the opening in the duodenum representing the former point of entrance of the hepatic duct into it was closed by suture. The scar tissue about the stump of the hepatic duct was excised and the stump of the duct was freed and mobilized as well as possible. At best, I could get a stump only a scant  $\frac{1}{2}$  inch in length. The duodenum was again drawn up to the liver and fixed in position by three linen sutures placed behind the stump of the hepatic duct. The anterior wall of the duct was incised to enlarge the size of the opening. A large flap consisting of the whole thickness of the gut wall was turned off the duodenum, and this was sutured to the posterior portion of the stump of the duct, so that the mucous surface of the duct was in continuity with the mucous membrane of the flap. One end of a piece of a good-sized rubber catheter 4 to 4 $\frac{1}{2}$  inches in length was passed well up into the lumen of the duct and the other end was placed in the duodenal lumen. The opening made in the duodenum by turning off the flap was now partially closed by suture and the hiatus still remaining in the duodenum was sutured by interrupted sutures of chromic catgut to the connective tissue about the hepatic stump and to Glisson's capsule. In effect, a second hepatico-duodenostomy was done over a piece of a catheter. The omentum was again wrapped about the location of the anastomosis.

remove the bemoostat and reapply it at a deeper level this move was the probable cause of my later trouble. I tied and cut the cystic artery. The dissection was a particularly dry clean one and the field was easily demonstrable. As I began to remove the gall-bladder I observed a single sudden gush of bile in the depths of the wound this made me suspect injury to the main duct, and my worst fears were realized when on examination of the removed specimen I found a section of the main duct more than  $\frac{1}{2}$  inch in length attached to the cystic duct. I made an end to end suture of the main duct over a T tube. Two stay sutures of fine silk and several chromic catgut sutures were used. The suture line was protected with omentum. A cigarette drain was placed in Morrison's pouch. At the end of three weeks the T-tube was removed. Bile then flowed freely through the abdominal wound and was still escaping when the patient left the hospital on September 28th. This discharge continued for two weeks longer and then suddenly ceased. The patient was seen November 3 1921 and found to be in excellent condition.

In December 1920 she became jaundiced again and the jaundice with occasional slight remissions, continued until her second entrance to the hospital September 6 1921. The jaundice the intense itching a chill now and then and some loss of weight were her only symptoms. It took a long time to convince her of the necessity for the second operation which was done September 7 1921.

Incision was made in the line of the incision of previous operation. The liver was enlarged and thickened. The duodenum was found intimately adherent to the former location of the gall-bladder. Careful separation of these adhesions led to our finding the stump of the hepatic duct in a mass of scar tissue. It was opened and apparently healthy bile escaped. There was stricture at the location of the suture line in the duct and the duct itself was obliterated for considerable distance. There must have been some degree of patency of the duct however because some bile had been getting into the intestinal tract all these months. Hepaticoduodenostomy after the method of Mayo was done. The patient did splendidly for six months.

necessary to ligature the artery close to the duct, as was evidently done in the case just mentioned.

In the present instance it may be said that never was an operation carried on in a drier field or with a clearer view of the anatomic relations: the common and hepatic ducts were in plain view; the cystic duct and the cystic artery which were unusually large, each had been isolated and clearly demonstrated to the assistants and students; for a good reason a hemostat placed on the cystic duct was removed and immediately replaced at a deeper level. One of two possibilities then became an actuality. The operator either engaged, inadvertently of course, a bit of the hepatic duct in the bite of the hemostat or by undue traction on the hemostat, pulled up and so angulated the hepatic duct that in cutting across the cystic duct he at the same time excised a bit of the main duct. Only after ligature of the cystic artery and removal of the gall-bladder was the catastrophe revealed in the portion of the main duct attached to the specimen. Let me remark here that after a cholecystectomy the specimen removed should *always* be examined carefully by the surgeon himself for only when he has assured himself that a portion of the main duct is not attached to the excised cystic duct may he be satisfied and feel secure. In support of this contention it may not be amiss for me to relate an incident which occurred in the practice of one of the most skillful and experienced surgeons in this country. He had completed a cholecystectomy and had closed the abdominal wound. He had even donned his street clothes and was about to leave the operating floor when he bethought himself to examine the specimen. To his consternation, he found a portion of the main duct attached to it. A second operation was done, with a very happy result. If such a thing can happen to one of our great surgeons, how much more likely is it to occur in the work of the average surgeon!

It goes without saying that in the doing of a cholecystectomy every care should be taken to avoid injuring the main duct. An adequate incision in the abdominal wall, knowledge of the anatomic relations and of possible anomalies (fortunately a normal relation exists in 75 per cent. of the cases) a well ex

Temporary drainage was provided for with rubber tissue. There was a rather profuse discharge of bile from the abdominal wound for the first twenty-four hours this had practically entirely ceased on the sixth day. There was no discharge thereafter and the patient left the hospital in excellent condition sixteen days after operation the jaundice had entirely disappeared, the mental condition had cleared up and the patient felt perfectly well again.

This case illustrates vividly the danger and consequences of operative injury to the main bile-ducts in procedures about the region of the gall-bladder even in the hands of those accustomed to dealing with the difficulties and experienced in handling the problems of surgery in this field. These are the days of frequent cholecystectomy and such a case is certainly worthy of note and comment, because it sounds a warning word and at the same time teaches a valuable lesson which touches on the matter of operative repair of the injury done.

The operator has done many cholecystectomies. As far as he knows, in but one other instance has he ever injured the main duct. Some years ago he had the humiliating experience of noticing a very evident jaundice in a patient previously not jaundiced upon whom he had done a cholecystectomy twenty-four hours before the following day the jaundice was still deeper. The obligation was then evident of telling the patient that another operation was necessary—not a pleasant experience for either patient or surgeon. At the second operation it was found that the needle which carried the chronic catgut ligature around the cystic artery had passed through the wall of the hepatic duct, and in the tying of the ligature the duct had been almost completely obstructed. The ligature was cut the cystic artery again tied, this time alone and the only untoward result was a moderate leakage of bile which ceased after a few days. The patient went on to a speedy and permanent recovery. I may say here that the use of a needle to carry a ligature about the cystic artery is not often necessary. It is sometimes advisable in a fat patient with friable tissues. But whether needle is used or not, keep well away from the hepatic duct. It is not

stump with the duodenum must be made by means of a tube alone. Sullivan's experimental work on dogs has been of much value in this field. McArthur makes use of a *long* rubber tube or even a catheter the funnel end being placed in the duodenal lumen practically the full length of the catheter is placed in the duodenum—an important consideration since it is by the tug of the duodenum on the relatively long length of catheter or tube (which if used should be cupped at the duodenal end) that final passage of the catheter or tube is assured. In end to-end suture of the duct an "anchorage" control thread (silk or linen) is placed about the catheter at the point of suture and the ends left long, brought out through the abdominal wound these are strapped to the skin of the abdominal wall by adhesive strips when the surgeon feels that the tube has been in place for a sufficient length of time (usually in thirty to sixty days) the control anchorage thread is cut and the duodenal tug does the rest. In cases in which end to-end suture of the duct is not possible careful search should be made for the distal end of the duct and every effort should be made to introduce the catheter or tube through the distal remnant into the duodenum. The reason for doing this when possible is evident. In case the distal end of the duct cannot be found or if found, is not sufficiently patent, a new opening into the duodenum must be made and two purse-string sutures placed around the newly made opening. These sutures are a protection against duodenal leakage and are said to provide something of a valve effect at the opening. Of course such portion of the catheter or tube as may be exposed between the two portions of the duct or between the duct and the duodenum must be wrapped in omentum. The duodenum should be mobilized to make this portion as short as possible. The danger in all these cases of artificially formed ducts is that of subsequent contraction and obliteration. Moreover in all cases of union of the hepatic duct to the duodenal lumen the danger of ascending cholangitis and hepatic infection is always present.

The experimental use of such tissues as the appendix a length of vein or a fascial tube as transplants to replace a destroyed

posed reasonably dry field, the severing of all adhesions either inflammatory or congenital identification of the cystic as well as the main duct (not always easy) the use of every expedient to increase accessibility to the deep parts and the employment of sound judgment as to the method of procedure are essential.

In the event of an excision of a portion of the main duct, what is the best practice? Without question immediate end-to-end suture of the divided ends. Only in the most exceptional instances is the portion excised of such length as to make end to end restoration impossible. Many ingenious methods have been devised for possible use in the exceptional case but these will not be discussed at length. Sullivan<sup>3</sup>, W. J. Mayo, Walton, Elliot, Eisendrath<sup>7</sup> and others have written illuminatingly on the matter and to their papers you are referred.

What then shall be our method? An end to end restoration of the continuity of the duct, the suture being made without artificial aid, is possible but, as a rule, it is difficult and is not often attempted. Usually the suture is completed over a rubber tube laid in the duct, the distal end of the tube projecting through the papilla into the duodenal lumen. Ellsworth Elliot, of New York, states that the repair of a defect, recognized and operated on immediately, is easy and satisfactory. I must say however that I am inclined to regard it as sometimes easy but often unsatisfactory in its ultimate results. It is a difficult task to reconstruct a workable common duct. Experience has turned me against the use of the T tube in these cases. Withdrawal of the tube from the duct after some weeks certainly causes much trauma to the duct at the location of the suture line and the consequent formation of connective tissue is the frequent forerunner of a complete blocking of the duct a few months later. The case now under discussion illustrates this point well. In my opinion L. L. McArthur of Chicago (who by the way is the pioneer in the use of a rubber tube as an aid to anastomosis, he having employed it for the purpose in 1898) has suggested the best method of using a tube in these cases of end to end suture and for that matter even in those cases in which suture of the duct itself is impossible and connection of the hepatic

## CLINIC OF DR. FRANK H. LAHEY

BOSTON CITY HOSPITAL

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### TUBERCULAR GLANDS OF NECK AND SPINAL ACCESSORY PARALYSIS<sup>1</sup>

We are concerned today largely with the occurrence of tubercular glands in the cervical region. They do occur elsewhere—in the axilla, groin, and mesentery—but present themselves most commonly to the surgeon in the form of tubercular cervical adenitis.

Most commonly we have seen them appear first just in front of or beneath the sternomastoid muscle opposite the angle of the jaw although the occurrence of glands of this type low down in the posterior triangle of the neck, along the edge of the trapezius has been by no means uncommon.

It has been our experience that by the time a gland has enlarged sufficiently to become noticeable and cause the patient to seek advice there are usually a number of other glands involved. Hence, as a rule if one palpates deeply beneath the sternomastoid with one finger in front of that muscle and another behind it, bringing both fingers together beneath it, numerous other glands will usually be felt. Palpation of the glands plays a considerable part in the differentiation of the various types of glands which occur in this region—simple inflammatory tubercular Hodgkin's disease, and true malignancy either secondary or primary (carcinoma or sarcoma). The simple inflammatory glands are usually not difficult to differentiate inasmuch as they have an obvious cause, run an acute or subacute inflammatory course, and extend over only a limited period of time.

Clinical Lecture and Demonstration to Fourth Year Students, Tufts Medical School.



portion of the duct has not been attended by sufficient success to warrant their employment in the human body

A question still unanswered is the extent to which mucous membrane will grow along a reconstructed duct. If it does not cover practically the whole reconstructed portion, will not contraction and obstruction again occur?

I regret that I did not know of McArthur's expedient at the time I operated on the case reported today. Had I made use of it at the primary operation, I believe I would have avoided the necessity of the subsequent hepaticoduodenostomies.

The present highly useful state of hepaticoduodenostomy we owe to W. J. Mayo. The operation is excellently set forth by word and picture in Balfour's recent article.<sup>8</sup> That some chance of later contraction and complete obstruction at the stump exists is indicated by my experience. It is possible, of course, that my technic in doing the work was not entirely correct, but I took all possible care to follow the directions given by Balfour. W. J. Mayo reports a case well fifteen years after operation. Too little time has yet elapsed for me to claim a permanent cure in my patient, who however is in first rate condition at present. The piece of catheter has not yet been passed.

It is desirable that every attempt, successful or unsuccessful, to repair or to reconstruct the main bile-duct should be recorded. It is probable that many cases have never been reported because the original surgical sin was the operator's and the attempt to relieve the result was unsuccessful. Surgeons frequently learn more from failures than from successes, but our human nature makes us more prone to report the latter than the former for our neighbor's perusal.

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Tubercular glands vary greatly in the degree of fusion which takes place between the glands and also in their consistency this factor being influenced largely by the degree of caseation necrosis and secondary infection which is present. Roughly speaking the most discrete of the chronic type of glands are those of the Hodgkin type and the least discrete those of the secondary carcinomatous metastatic type, the tubercular type being located somewhere between the two extremes, dependent upon the amount of secondary infection present in the glands.

Chronicity has been, in our opinion, one of the most reliable diagnostic features in connection with tubercular glands of the neck. Cervical glands which persist over a period of months without evidences of acute inflammation and with relatively little increase in size are in all probability tubercular in character. The only group simulating these conditions is that of the Hodgkin type.

The occurrence of tenderness is also of value in differentiation. Rarely do tubercular glands reach the size even of a small lime without at least a few of the glands showing some degree of caseation necrosis, and rarely does caseation occur without some degree of tenderness and secondary liquefaction and infection. On the other hand, glands of the Hodgkin type are painless and not tender.

The tendency to caseate and become secondarily infected characterizes only the glands of the tubercular type as suggested in the preceding paragraph but the possibility of the occurrence of both tuberculous and Hodgkin disease as combined lesion should be kept in mind.

Fever does not occur with tubercular glands except in the presence of secondary infection. In the presence of glands located in the cervical region the occurrence of glands elsewhere as in the axilla and groin should make one extremely cautious in the diagnosis of tubercular denitis. The occurrence of glands on both sides of the neck is frequent the occurrence of tubercular glands in the axilla as well as cervically is not common and when present is frequently a manifestation of late

extension from the cervical into the axillary chain. The occurrence of cervical axillary and inguinal tubercular glands is a condition which we have never observed.

Where incision and drainage has preceded one's observance of the case the chronic character of the sinuses lined as they are by the foul fungating tubercular granulations, is of value in marking them as tubercular in character. Sinuses which persist over weeks of time with the possibility of actinomycosis eliminated will in a great majority of cases prove to be tubercular in character. These lead to the tubercular granulation-lined shell of a gland which has gone through the process of caseation necrosis, liquefaction, secondary infection, and rupture through the skin or surgical drainage. Sinuses which close and reopen themselves are also as a rule, those leading to such an incompletely healed gland.

The treatment of this condition does not consist of any single method but, because of the variety of phases in which the condition occurs, necessitates at times the use of all available remedial measures which may be listed in the probable order of importance as follows. (1) The removal of all possible septic foci draining into this region, such as teeth, tonsils, and adenoids tonsils primarily because of the fact that they doubtless in many cases represent the original portal of entry of the tubercle bacilli into the lymphatic system, and next because in tubercular infections it is a sound surgical principle that when such an infection is to be dealt with it should preferably remain a purely tubercular infection rather than become mixed in character. Furthermore, the assumption is reasonable that glands saturated with toxic material from such foci (teeth tonsils, or adenoids) more readily become involved from adjacent tubercular glands than those unaffected by such foci. Therefore, the very first consideration in cervical tubercular adenitis should be the elimination of those foci.

(2) The next measure of importance and essential for application in every case is supervision and control of living conditions. If the circumstances of the individual permit, it may in some cases be necessary to establish even the rigid régime of the

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The tendency to caseate and become secondarily infected characterizes only the glands of the tubercular type as suggested in the preceding paragraph, but the possibility of the occurrence of both tuberculous and Hodgkin's disease as a combined lesion should be kept in mind.

Fever does not occur with tubercular glands except in the presence of secondary infection. In the presence of glands located in the cervical region the occurrence of glands elsewhere as in the axilla and groin, should make one extremely cautious in the diagnosis of tuberculous adenitis. The occurrence of glands on both sides of the neck is frequent the occurrence of tubercular glands in the axilla as well as cervically is not common and when present is frequently a manifestation of late

We regret that we have not up to the present made use of tuberculin and shall in the future avail ourselves of this additional measure in the treatment of this condition. In proper doses no harm is done by it, and the recent report of Dr. R. H. Miller from the Massachusetts General Hospital, concerning the use of tuberculin in tubercular cervical adenitis indicates that it need not necessarily be wholly abandoned because in itself it is no panacea for tubercular processes.

In this connection as students you would do well to bear in mind that there is always a tendency in medicine first to claim for a measure marvelous curative merits and virtues as a sole and single method of treatment, then to discard it because it fails to accomplish the cures erroneously claimed for it, and finally to rescue it from utter disuse attaching to it whatever limited degree of merit it rightly deserves. Such has undoubtedly been the case with tuberculin.

In the same paper spoken of in a foregoing paragraph are favorable reports of the use of the Alpine lamp in certain cases, particularly as to the closure of sinuses.

Radical surgery in the treatment of tubercular cervical adenitis is now in a stage of the reactions cited in connection with tuberculin. It is on the way to rejection at present, owing to its promiscuous use as a sole and single curative measure yet while we have no sympathy with extensive surgery primarily applied in this condition, there are none the less many extensive and persistent cases of tubercular cervical adenitis in which surgery must be employed even with the ever-present possibility of shoulder function limitation due to a cut spinal accessory nerve and trapezius paralysis.

Surgery should be limited first to incision and drainage of broken-down tubercular glands with secondary infection. In such cases large incisions, as in septic processes elsewhere, are not necessary since the sinuses, if kept open a short time will become lined with tubercular granulations and will then themselves persist. It is applicable also in the discrete and localized

pulmonary tuberculosis patient in order that every possible degree of resistance may be made available. In those cases in which the financial status does not permit enforced rest, careful supervision of living conditions such as the character of the diet and the proper use of leisure time for resting and sleeping, is of distinct value. An extensive experience with the postoperative care of thyroid patients has taught us how practicable it is to improve the use of the limited leisure even in the case of an individual having fixed hours of labor provided instructions as to the use of this leisure are laid down for him and followed with diligence.

*x Ray* In our opinion, as a general measure should precede surgery in order of importance. It should not be employed in the presence of a mixed infection until the inciting foci have been removed or until the abscesses consequent to the mixed infection have been drained. However when the process is purely a tubercular one it should be employed together with the above-mentioned measures and persisted with over a considerable period of time, provided the process is remaining localized and other groups of glands are not becoming involved. It is, of course needless to state that to obtain the maximum dosage without skin damage expert knowledge of the technic of Roentgen therapy is required. We have had several cases of cervical tuberculous adenitis returned to us by the roentgenologist with a development of local abscesses as the result of x-ray therapy and it is our feeling that during such therapy those glands which possess any marked degree of caseation necrosis will usually liquefy and require incision and drainage. In this we have seen no disadvantage, the treatment being resumed as soon as drainage has been established. As stated elsewhere<sup>1</sup> in an article on this subject, we believe that x ray therapy should be continued up to the point of demonstrable extension of the process, and that failure to obtain immediate retrogression of the glands is not an indication that such action will not occur as a later effect.

<sup>1</sup>End-results of the Surgical Treatment of 18 Cases of Tuberculous Cervical Adenitis, Boston Med and Surg Jour. vol. LXV, No. 9 pp. 280, 281 March 2, 1922.

We have reported elsewhere 12 collected cases of spinal accessory paralysis, some our own and some of other surgeons.



Fig. 346.—Case II Left spinal accessory paralysis. Similar to Case I except that the scapula is not visualized.

In some of the cases the nerve was cut during simple incision and drainage in most of the cases it was cut during radical and



Fig. 347.—Case III Right spinal accessory paralysis

extensive removal. In some of the cases persistent paralysis has occurred even though the nerve was carefully preserved through



glands that are easily removable without extensive dissections and that have failed to disappear under the measures already outlined. It is likewise applicable furthermore in those cases extending into and involving other glands in spite of the use of the measures already listed and also in those enormous and disfiguring masses of such extent as to be hopeless of relief except by means of radical removal following which one should realize that the measures already spoken of are as essential as post-operative prophylaxis as is their trial as curative measures in moderate and suitable cases.



Fig. 345.—Case 1. Left spinal accessory paralysis. Note the sagging left shoulder, the loss of the shoulder contour line and that the left scapula has moved away from the vertebral line as compared with the normal right scapula.

Spinal accessory paralysis is perhaps the most serious complication of extensive surgical removal of tubercular cervical glands. The decision to employ the radical surgical method of treatment should only be made with full appreciation of the very serious possibility of this accessory paralysis, and under conditions that justify even this occurrence by the serious needs of the case, i. e. where more conservative measures have failed to check the progress of the disease where the extent of the process is such as to make the employment of these measures hopeless and dangerous to the life of the individual.

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In some of the cases the nerve was cut during simple incision and drainage. In most of the cases it was cut during radical and



Fig. 347—Case III Right spinal accessory paralysis

extensive removal. In some of the cases persistent paralysis has occurred, even though the nerve was carefully preserved through



Fig. 348.—Case III. Side view of same patient. Note again in this case the sagged and rotated scapula, together with the flattened shoulder as compared with the normal left shoulder.



Fig. 349.—Case IV. Bilateral spinal accessory paralysis. Note the sagging of both shoulders, and on the left the superior angle of the scapula projecting above the contour line, as mentioned in the text.



Fig. 350.—Case IV. Note in this view, as in Case I, the scapula sagging well away from the midline, due to loss of trapezius support. Note again the prominent superior angle of the scapula.



Fig. 351.—Case IV. Patient endeavoring to accomplish the greatest possible degree of abduction. Note the powerful deltoid in contraction, yet barely 90 degrees of abduction can be accomplished.

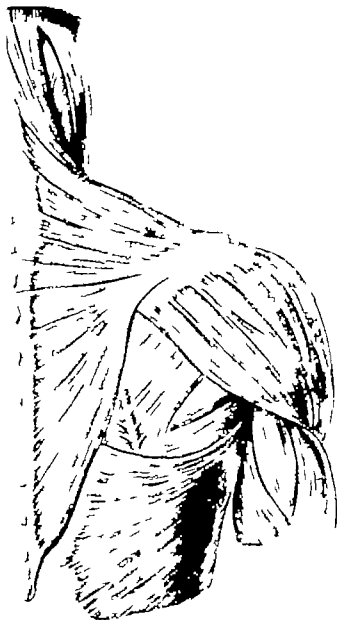


Fig 352.—A semi-diagrammatic illustration made from dissection of the trapezius and shoulder girdle muscles. Note how the trapezius with its broadly attached base act as an anchor muscle between the powerful shoulder girdle muscles here, showing deltoid, subscapularis, and teres muscles, all of which find their entire origin except a few fibers of the deltoid rising on the clavicle, on the scapula, and are inserted into the humerus. This demonstrates why with trapezius paralysis, the shoulder girdle and the scapula moves outward.

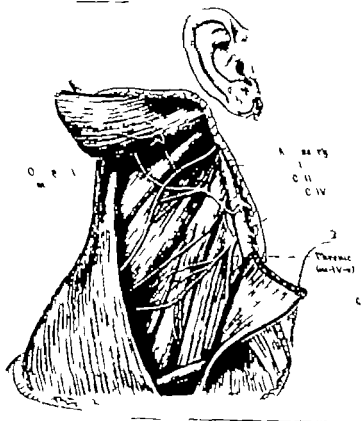


Fig 353.—A semi-diagrammatic illustration made from dissection of the spinal accessory and the second, third, and fourth cervical nerves. Note the junction of the second cervical with the spinal accessory nerve to form the sternocleidomastoid plexus. Note, also, from their location, how possible it is to injure not only the spinal accessory but also the second, third, and fourth cervical in dissections about the great vessels. In this illustration the spinal accessory is pulled somewhat upward by the turned-up sternocleidomastoid muscle.

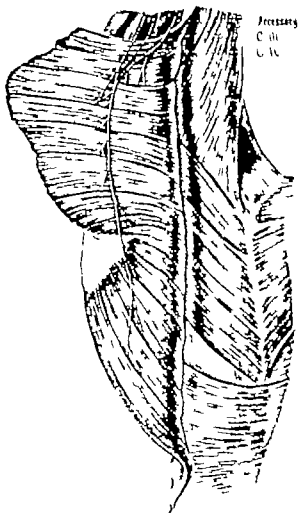


Fig. 354.—A semi-diagrammatic illustration made from dissection of the spinal accessory throughout its course beneath the trapezius. The trapezius has been turned back with its left base attached at the midline. Note the junction of the third and fourth cervical nerves with the spinal accessory to form the subtrapezius plexus. It is these two cervical nerves which are depended upon to maintain function when the spinal accessory trunk is cut.

out its course. We therefore feel justified in saying to you that when extensive dissections of tubercular glands are undertaken, particularly in the not unusual cases where the spinal accessory nerve runs through a necrotic tubercular gland at the level where the nerve passes beneath the sternomastoid the occurrence of trapezius paralysis must always be considered as a possibility.

In order that you may appreciate the seriousness of this lesion (spinal accessory paralysis) we are going to show a few patients presenting this lesion and review briefly the surgical anatomy of the spinal accessory nerve and the shoulder girdle muscles. In the patients showing this lesion notice the following features. Observe the marked lengthening and sagging of the shoulder on the affected side due as will be shown you on the anatomic specimen, to loss of the trapezius, which is the anchor muscle fixing the scapula to the midline. Observe how the scapula sags away from the midline in these cases because of the loss of this support. Note the prominence of the superior angle of the scapula due to the sagging down of the outer angle carrying the weight of the arm and to the fact that the superior angle is kept supported by the greater and lesser rhomboids. And finally observe the degree of function lost as the result of the paralysis of the trapezius. Note that abduction can only be accomplished to just short of a right angle.

There is undoubtedly a tendency to forget that while the first 90 degrees of abduction is accomplished by the supraspinatus and deltoid muscles, the last 90 degrees is accomplished by rotation of the scapula, brought about largely by the trapezius and aided slightly by the serratus magnus.

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higher up. Absence of this junction is often noted by anatomists, and in this series, as stated in the text, either must have existed or the third and fourth cervical nerves have been interrupted, together with the spinal accessory nerve. Note in the illustration beneath the turned-up trapezius the greater and lesser rhomboids, the sole muscle, except the levator anguli scapulae, holding the scapula toward the midline. It is the overstretching of these muscles which doubtless produces the shoulder ache immediately following the injury and passing away later when these structures are stretched out and paralyzed.



Finally in dealing with the anatomy of this subject, we wish to present to you this specimen made under our direction in the anatomic laboratory showing the course and relations of the second third fourth, and fifth cervical nerves, the spinal accessory nerve and the subtrapezius plexus.

Note particularly in this dissection the junction made between the spinal accessory nerve and the third and fourth cervical nerves beneath the superior border of the trapezius muscle to form the subtrapezius plexus as upon the completeness of this junction depends the assumption of the innervation of the trapezius by the cervical plexus when the spinal accessory is severed.

It is often said that if the spinal accessory nerve be cut higher in the neck its function will be assumed by the cervical plexus. From the dissection here shown you can readily see how this function is assumed. You should bear in mind however that this junction between the spinal accessory and the third and fourth cervical nerves is not constant one and if not present, paralysis will occur following severing, and further that the dissection of glands about the internal jugular which injures the spinal accessory nerve also endangers and at times injures the third and fourth cervical nerves, in which case, also paralysis occurs.

## CLINIC OF DR. WILLIAM C. QUINBY

PETER BENT BRIGHAM HOSPITAL

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### RENAL TUBERCULOSIS

CASE I.—The first patient whom I wish to consider with you today is a woman of thirty-seven years who entered the hospital on October 16 1920 complaining of hematuria. Other than this there had been no abnormal sign or symptom. The bleeding had been going on for four days when she had the wisdom to apply for investigation and treatment. Concerning her previous history she had been married for twenty-one years, had never been pregnant, and with the exception of malaria at the age of twelve she had always considered herself healthy. Twice before she had been in this hospital—once in 1916 for laryngitis and more lately in 1919 for a dry pleurisy. She gives a history of having occasional colds, from which she has recovered readily. There has been no chronic cough. Her appetite is good and the menstrual history is not remarkable. Concerning the function of urination, she states that for several years she has had to rise from three to four times at night in order to urinate.

DR. QUINBY (to the patient) Was that urination painful? Did you wake because you had pain?

PATIENT No.

DR. QUINBY Has it lasted for a long while?

PATIENT Yes.

DR. QUINBY But not all your life.

PATIENT No.

DR. QUINBY Did it come on gradually?

PATIENT Yes.

DR. QUINBY It evidently was not an affair which impressed itself markedly on the patient. It is not normal however to rise three to four times at night to urinate. In the previous

examination in 1919 was the urine normal? Have we got the previous history?

DOCTOR Yes the urine was normal.

DR. QUINBY There was apparently no abnormality in the urine while the patient was on the medical service something over a year ago. Therefore we have as the one outstanding symptom hematuria persisting four days without any other associated symptoms. She had no pain no increase in frequency and the general physical examination which was done was negative. Examination of the urine showed it to be red, with a large trace of albumin and many red blood-cells. There was no fever. What do you want to ask about next?

STUDENT Is there any way to find out the origin of the bleeding?

DR. QUINBY There is one thing we must always insist on in a woman who complains of hematuria we must be sure that the blood comes through the urethra. It may be from the uterus and be mixed with the urine, so that the individual's observation may be at fault in this regard. How would you find that out? There is one simple procedure.

STUDENT Get a catheter specimen.

DR. QUINBY Yes if you find bloody urine coming from the catheter you know then that the genital tract can be excluded. That was done and it was perfectly evident that the bleeding was from the bladder. Now what do you want to determine next?

STUDENT Test the renal function.

DR. QUINBY You mean the red test the phthalein test? That was 30 per cent. Does that tell you anything? Is it normal?

STUDENT It is normal.

DR. QUINBY It is a little low but is it so low that it is an evidence of disease? What would be your reaction toward 30 per cent. test?

STUDENT I should be suspicious.

DR. QUINBY It is on the low edge of normal. Would you therefore not want to control it? Why not do the test over

again? If you take the temperature of a patient one observation is not nearly so good as two or three. A 30 per cent. function is very suggestive of there being some renal abnormality but there may be some error in this single observation. The normal error in the phthalein test is about how much?

STUDENT About 5 per cent. above or below the actual facts, 10 per cent. in all.

DR. QUINBY Yes. In this individual instance I should say that 30 per cent. was not especially remarkable unless confirmed by subsequent tests. The hemoglobin was 75 per cent. That is also a little low. White blood-cells 8000. No differential count was made. No evidence of secondary anemia was present. Mr. X. what do you want to do further?

STUDENT Make an x-ray.

DR. QUINBY Yes. x Ray plates were made but of what?

STUDENT Of the urinary tract.

DR. QUINBY There was no shadow suggestive of stone if that is what you are thinking of. The examination of the bladder by cystoscope is the next most important thing. That was done with the following findings. In the first place the blood was immediately seen to come from the left ureteral orifice. On the right side there were two orifices, and from these the efflux was clear. What do you think about that? There was a superabundance of ureteral orifices. Does that mean anything special? Is it very uncommon to have a double ureter?

STUDENT No.

DR. QUINBY It is not at all rare. You must always look for more than one orifice. Besides this in the trigone and adjacent bladder wall there were seen small yellowish nodules surrounded by a narrow zone of hyperemia. The divided renal function was 12 per cent. from the left side—that is the side that was bleeding and 10 per cent. from the other two ureters during the time of observation, which was ten minutes. What would you think about that for function? In ten minutes there was a total output of dye of 22 per cent. Immediately that answers your previous doubt about the 30 per cent. and means that the first reading of the phthalein test was fallacious. It could not have

been a true index of the renal function because at this subsequent examination the output was 22 per cent. in only ten minutes while the first collection was made over a period of two hours. Therefore as definite findings, you have first the origin of the blood from the left side and second the observation in the bladder mucosa of these rounded nodules. They are somewhat hard to describe. (Draws picture on blackboard) These affairs are under the mucous membrane of the bladder. They are round as a rule, and opaque, and they are surrounded by a halo or a little reddish injection, and there is not much change in the bladder wall around them. The nodules are only slightly raised above the surface. They look for all the world like very small, only slightly raised pustules. They are quite characteristic of one type of bladder involvement, and they have a definite name. What they represent is a localization under the mucosa of the bladder of the tubercle bacillus, and they are therefore called submucous tubercles. Once seen, they are very easily recognized although not always clear on first observation. That gives you another lead in regard to the diagnosis. But since any of your observations may be false in general, I should want to check the character of these affairs in the bladder wall by something else, which may confirm or disprove our suspicions as to their nature. What makes the diagnosis? I mean, what makes the diagnosis in any case?

STUDENT Finding the bacillus.

DR. QUINBY Yes that is the next thing to do. Either find it in the sediment of the urine examined by microscope or by the inoculation of a guinea-pig. I feel pretty sure that this will be successfully accomplished, though not yet done.

Assuming that the condition here present is caused by the bacillus of tuberculosis, what is its primary focus? Do you think that these tubercles to be seen by the cystoscope just under the bladder mucosa are the primary seat of the disease in the urinary tract?

STUDENT They very likely are.

DR. QUINBY No this is not probable. It has been found that tuberculosis is practically never primary in the bladder.

and similarly other infections of the bladder such as infections by the pus-producing organisms, are only rarely primary in the bladder. I want to bring that point out. You must always recognize the fact that, although you may find extensive involvement of the bladder by the tubercle bacillus this is not its primary focus. What do you suggest as a possible origin in this case?



Fig. 355.—Case I. Injection of renal pelvis of kidney high as bleeding. On the opposite side one sees the radiographic catheters in place, demonstrating the presence of double ureter extending as far up as the kidney itself. On this side, however, there were no pathologic findings.

STUDENT: The kidney.

DR. QUINBY: Yes. You found a definite hematuria, and it was shown conclusively by two methods, both ureteral catheterization and ocular inspection, that the blood came from one side. Why was that kidney bleeding? You are looking for an infection above the level of the bladder which can serve as a cause of what you see in the bladder, and the logical deduction is that the

hematuria comes from higher up namely from the kidney. Now the pyelograms are here and I want you to see them. (Pointing to plates.) You see on the right side two catheters going all the way up to the kidney the pelvis of which gives a typical picture of a developmental anomaly which is not at all rare namely a double ureter and double pelvis. The pyelogram on the left side does not appear to be abnormal in any especial degree, though this is the side from which comes the blood. This does not in the least exclude the presence of tuberculosis in the kidney however it merely means that the process is early and has not caused erosion and distortion of the normal outlines.

To sum up We have painless hematuria which has been found to originate in the left kidney together with areas in the bladder trigone which look like submucous tubercles. The pyelogram and renal function are normal. We strongly suspect that these signs are the expression of a tuberculosis of the left kidney but confirmation of this by finding the tubercle bacillus has not yet been carried out. The outcome of this case will be reported to you later.

Now before we go on to the next patient, are there any questions about this one? Tuberculous infection of the kidney causes hematuria, and bladder symptoms may be entirely absent the only difficulty being the blood in the urine, but no local pain at the level of the kidney and no symptomatic involvement of the bladder. You will have to make your mental picture of urinary tuberculosis from numbers of cases, as it varies markedly as you see here, in its symptomatology. I am not absolutely sure that this is the diagnosis in this individual case. However the picture seen on cystoscopy is practically never seen except in cases of tuberculosis. Therefore, renal hematuria, painless frequency and the fact that tuberculosis is never primary in the bladder is what I want you to remember as possibly the result of renal tuberculosis.

Case II.—The next patient is somewhat different, and entirely so in regard to history. He is twenty-six years old civil engineer. He came to the hospital in September complaining of a

dull ache in the right side which was persistent. After that had existed for two weeks he began to complain of increasing frequency of urination but this was not accompanied by any pain. His urine was slightly cloudy but there was no blood seen. There was no loss of weight and no impairment of health. (To patient.) Did you notice that your urine was cloudy yourself?



Fig. 356—Case II. Plain -ray of patient showing, in general, region of lower pole of right kidney. The exact location of these shadows needs further confirmation.

PATIENT: Yes, I noticed it myself.

DR. QUINBY: It must have been pretty definitely turbid to have the patient notice it himself. General health has been good, subject to frequent colds. No cough or pulmonary infections. Physical examination showed a well-nourished, well-developed man with normal temperature, pulse, and respiration. There was tenderness in the abdomen and the right kidney could be palpated. It was tender but apparently not enlarged. The



urine showed a very few white blood-cells and a very rare red blood-cell no albumin no casts. Phthalein 70 per cent. in two hours. That is a perfectly satisfactory amount, you do not need to repeat that. x Ray plates of the kidney showed areas of increased density at the region of the lower pole on the right side, and these areas were very interesting because they were so un-



Fig. 357.—Case II. I. jected kidney showing that shadows are definitely in its lower pole and associated with an absence of the normal lower calyx. Note also somewhat dilated ureter.

usual. This is the plate (pointing to plate). These shadows, which look vaguely as you might imagine chicken crop might appear are not clearly enough localized to determine where they are. Your first guess would be that the shadows were in the intestine and due to intestinal contents. However we have positive proof that they were not in the intestine in the fact

that they still persisted after active catharsis. They might be in the kidney. Therefore this outline was made of the kidney pelvis by the injection into it of a solution opaque to the x ray. You see those shadows still down in the lower portion of the kidney below this inferior calix, which seems cut off. The other calices do not seem abnormal. This would place those shadows in the kidney cortex. A point which made it seem doubtful whether those shadows were in fact in the kidney was raised by the nearly normal chemical and microscopic examination of the urine and the relatively short duration of symptoms. If you suppose those shadows to be due to a pathologic process in the kidney you must presuppose also that a considerable time must have elapsed for their formation because those shadows mean deposition of lime salts in an area or in structures which have previously been deprived of their blood-supply. From the history and examination of the urine it would hardly seem that enough time had elapsed for this process to occur.

There is another condition which we considered very carefully which might give rise to those shadows. Has anyone any idea of what it may be?

STUDENT: Calcified tubercles.

DR. QUINBY: Where?

STUDENT: Retroperitoneal lymph-nodes following tuberculous mesenterica.

DR. QUINBY: Yes. We find numerous instances of shadows such as these being caused by that condition so that we have to consider it carefully before coming to a conclusion. The examination of the urine from the kidney on this side showed pus but in no great extent. The tubercle bacillus was not to be found. We were therefore faced with the situation as I have given it to you. Over a rather prolonged period of observation the patient's pain persisted. He is a very well educated type and can give you the true value of his symptoms. We can believe him when he says that his pain persisted uninfluenced by any of the measures which we employed to investigate or help him. The presumption was strong that he was suffering from tuberculosis of the kidney. It therefore seemed entirely justifi-

fiable to investigate the kidney by operation. Sometimes such areas of tuberculosis are walled off from the rest of the organ. It is not so very uncommon to find that the case. Operation was undertaken two or three days ago and that was the condition found. The localized area of tuberculosis in the lower pole of the kidney did not communicate in any way with the renal pelvis. Since operation the patient has come on splendidly. He has a little difficulty with gas still, but his chart shows a strikingly level career since operation, with no elevation of temperature.

Now in this second patient you have a further example of the variation in symptomatology caused by the same disease under different circumstances. The pathologic condition in this boy's kidney was tuberculosis, but it was a purely localized affair walled off from the pelvis, so that it did not drain into the urinary tract. There was no infection of the bladder. We had only the aid of the x-ray shadows to justify us in operating on him.

Concerning the pain felt in such lesions as this, I have a feeling that in parenchymatous organs it is due to tension. Tension undoubtedly is the cause of the pain which one has in renal colic. The pain is not due so much to the presence of the stone as to an increase in pressure. The same is true in some of the conditions in the liver. In both instances it is to be supposed that the pain is due to tension. In order to fulfil their functions you must remember that the organs in their daily activity vary in size and they must, therefore, be of an elastic nature. In the case of the kidney if it cannot respond to the diuretic stimulus which reaches it at frequent intervals during the day by the normal increase in size which usually accompanies such stimulus, then tension within the organ is increased and pain ensues.

In our first patient you had an outstanding symptom, hematuria, pointing to tuberculosis. In this patient, also with renal tuberculosis, you have no such thing, but you have pain in the region of the kidney and again, in another case which I will briefly recite to you from memory one finds still different symptomatology.

Case III.—The third patient was a woman about thirty five years old. She had suffered from her bladder for fourteen years when I first saw her. She had frequent, painful urination to such an extent that she could hardly carry on her daily activities. She had had an artificial opening made so that she would not have to use her bladder—a so-called vesicovaginal fistula. She wore this fistula for over two years and then her bladder being entirely free from symptoms her surgeon closed it again. Following that there was a period of practical health as regards bladder function until about five years later when the same symptoms began again, and added to them there was some slight inability to hold the urine. Her troubles by that time had gone on for fourteen years, and the two physicians who had treated her had both died. So she fell into my hands. It was perfectly evident that she had had tuberculosis of the bladder because there is hardly any other disease of the bladder that would give that picture. Knowing the fact which I have told you that tuberculosis is practically never primary in the bladder I started to find the source of the tuberculosis. I found what I had suspected—a ureteric orifice on one side entirely functionless and quite impervious to the passage of a ureteral catheter. The x ray examination was entirely negative, but on operative investigation we found a kidney which had been entirely transformed into caseous material, and a ureter which was entirely occluded and converted into a fibrous cord. It is hard in a way to see why such a kidney needed to be removed. There was no evidence of any active process remaining in it. It seemed to have been entirely converted into caseous material. But following operation the patient gained over 25 pounds in weight, though she had considered herself well except for her bladder before operation. As far as I know she is entirely well today. This was an instance of the only way in which nature is believed ever to heal a tuberculosis of the kidney, namely by entire destruction of the organ. The process has been called autonephrectomy. I relate this case to you to impress on you the fact that over a long period of years renal tuberculosis may exist without any symptoms at the level of the kidney.

In regard to treatment we have as yet no instance of proved healed renal tuberculosis. No pathologist has been able to demonstrate healed renal tuberculosis. The only answer to the condition is to remove the kidney and in the instances in which nephrectomy has been done for renal tuberculosis the end-results have really been better than you might expect. It is said that when one kidney has been removed the prognosis is practically as good as if there had been no disease at all if the patient survives the operation for two years. Within the first two years after operation about 25 per cent. of the patients will succumb from a continuation of the tuberculous infection in some other portion of the body but having survived the operation for two years there is sufficient resistance to make such a person immune to any further attacks.

## CLINIC OF DR. ELLIOTT C. CUTLER

PETER BENT BRIGHAM HOSPITAL

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### THE ETIOLOGY OF POSTOPERATIVE PULMONARY COMPLICATIONS\*

THE seriousness of the dilemma that a pulmonary complication constitutes in a postoperative patient has long stimulated the interest of surgeons. Such complications have existed since most ancient times but it was only with the advent of inhalation anesthesia that operations became sufficiently numerous to demonstrate the relation of such complications to the operation. It was only natural therefore that the anesthesia received the blame for the etiology of these conditions. Moreover it was easy to suppose that the irritation of the drug either directly injured the lung or by lowering the local resistance facilitated the entrance of bacteria already present or aspirated during the unconscious state. The dangers of the aspiration of vomitus and oral contents was much emphasized. However shortly after the introduction of cocaine† as an anesthetic reports began to appear illustrating the frequency of pulmonary complications following anesthesia by this method (Mikulicz and Kausch<sup>2</sup> 1900 Gottstein, 1898). Under this condition all of the foregoing reasons were immediately vitiated and first hypostasis due to the position and later embolism from the operative field were proposed as the most plausible etiologic factors. From that time on the discussion has waged pro and con inhalation anesthesia as the cause of these various postoperative pulmonary sequelae.

From the Surgical Clinic of the Peter Bent Brigham Hospital

†V. K. Asch<sup>3</sup> introduced cocaine as an anesthetic in 1879. Carl Koller of Vienna, first used it as surgical adjuvant in eye operations in 1884 and J. L. Corning<sup>4</sup> introduced the spinal method in 1885. Reclus<sup>5</sup> in 1895 described its use as local anesthetic in other fields, and Cushing<sup>6</sup> papers in 1898<sup>7</sup> and 1900<sup>8</sup> are among the first to generally recommend this method of anesthesia to surgeons.

From time to time additional factors have been suggested as of minor or major etiologic importance. Those worthy of any discussion at the present time are chilling, sepsis, asphyxia, acidosis, and the existence of a preoperative pulmonary disease. The claim however has never been pressed that these conditions alone cause such complications and exponents of both the irritative and embolic theories have used one or all of the secondary factors as an aid in the explanation of their own hypothesis. And as it appears, both do so with some justification.

Those favoring either theory may claim that chilling asphyxia and the acidosis secondary to anesthesia lower the resistance to infection in general. The presence of a septic operative focus is claimed by the embolic school as the source of septic emboli, which, according to their size number the type of bacteria, and the resistance of the individual, may result in any of the pulmonary complications from fatal embolism or lung abscess to pneumonia. Whereas those thinking that the irritation of the anesthetic is the chief factor point out that with most infections there is an associated bacteremia and that the organisms thus circulating will be able to obtain a foothold in a lung injured by the irritation of the anesthetic and the aspiration of the mouth contents.

Even the secondary factor of the existence of pulmonary disease before the operation has been used by both sides in the explanation of the mechanism of their particular theory. And such pre-existent pulmonary disease may vary from quiescent or incipient tuberculosis to a chronic bronchitis or simple emphysema. Those who claim that irritation from the anesthesia is chiefly to blame for these complications certainly have much on their side since it is beyond cavil that inhalation anesthesia and especially ether do unquestionably stir up sufficient pulmonary irritation to bring about serious lung lesions in such patients. On the other hand, it is quite within reason that should multiple fine emboli from the operative field reach such an already injured lung with dormant bacteria present, they would bring about

Either external chilling by the omission of suitable coverings after operation or internal chilling from the use of cold wet packs inside the body

sufficient vascular changes to allow such organisms to gain a foothold and create an active lesion. Moreover we have demonstrated to our own satisfaction, by the use of routine x-ray lung examination both before and after operation, that not all lungs proved the seat of such quiescent or chronic lesions before operations flare up into activity following surgical intervention.

The result of even such a brief discussion of these many lesser factors must be sufficient to demonstrate their secondary nature in the production of postoperative pulmonary complications.

In speaking of these unfortunate sequelae to operations we must be careful to restrict the cases included to those in which the disease is a real complication and not a direct concomitant of the operation, as in thoracic explorations or an antemortem condition such as the usual terminal pneumonia in old people dying with general sepsis. One should also exclude such cases as those who die from pulmonary complications secondary to bulbar paralysis since in these cases the cause stands sharply outlined and is not in any definite relation to the operation *per se*.

Excluding these groups of cases we find that the percentage of pulmonary complications following operations is close to 3 per cent. of all cases operated. The frequency of these sequelae is further emphasized in the fact that often these complications appear in cases in which the surgeon had every expectation of a rapid and undisturbed recovery. And the fact that the mortality figure reaches 0.5 per cent. enhances the seriousness of the condition. The fatal cases are divided between embolism and pneumonia.

A survey of all the types of such complications that occur reveals the fact that there are certain anatomic fields in which these sequelae follow operation most commonly. These are largely restricted to two great areas one the abdomen, and the other the mouth face and neck. Moreover the percentages of such complications bear no fixed ratio to the anesthetic used. In abdominal operations the incidence with local anesthesia is quite as high as when inhalation anesthesia is used.<sup>24</sup> In operations on the mouth face and neck, however the use of local anesthesia



has undoubtedly cut down both the morbidity and mortality percentages. This is unquestionably due to two factors one, the lessened chance of aspiration with a slow clear dissection under local anesthesia and two the greater ease in obtaining an aseptic field when the apparatus of inhalation anesthesia is out of the way. It is important to fully realize the importance of infection in these neck and face cases since the obvious danger of aspiration is apt to lead physicians and surgeons to think this the only peril. We now know however that such complications occur quite freely in these operations when local anesthesia is used, and it must be accepted that under this condition the infection probably reaches the lung by the rich lymphatic supply which drains from the neck directly to the roots of the lung.

We find classified as pulmonary complications all the known types of pulmonary disease viz. lobar and bronchopneumonia, bronchitis, pleurisy, empyema, infarction, embolism, and lung abscess. As was to be expected one finds that in the earlier writings pneumonia and embolism are almost the only complications described their severity and frequent fatal termination making them easily distinguishable. In the pre-antiseptic days Silk<sup>10</sup> reports that Cheevers in 1843 found a very high mortality percentage from pneumonia after operation. Such high mortality however must be studied with reservation, since there were doubtless many cases of bronchitis, pleurisy, and infarction that passed unrecognized, and though this would increase the morbidity figures, it would lower the mortality percentage. In earlier days records were not kept with the care which we now put upon them, and simple disturbances during convalescence doubtless passed undescribed and hence unavailable to the future student. A good example of this is seen in a study of an early report from the Presbyterian Hospital, New York. Schultz<sup>11</sup> in 1898 reported 22 pneumonias in 5724 patients anesthetized (0.38 per cent.) whereas Whipple,<sup>12,13</sup> studying cases in the same hospital fifteen years later found 42 pneumonias in 1902 patients in 1913-1914 (2.2 per cent.) and 97 pneumonias in 3719 patients in 1915-1916 (2.6 per cent.) Studies of our own in 1916-1919<sup>14</sup> 1920<sup>15</sup> and 1921 show the same tendency to get out more cases

with more careful study. Thus a study of 3490 cases in 1916 revealed a morbidity of only 1.86 per cent. whereas in 1919, 1920 and 1921 the figures reached 3.52 per cent., 3.93 per cent. and 3.08 per cent., respectively. These latter figures agree with the more recent studies of McKesson.<sup>22</sup> The fact that we have obtained practically the same percentage over a number of years in which we have been especially interested in this subject and under conditions that have allowed the accurate recording of all such sequelae seems to show that 3 per cent. may be assumed to be the average percentage of patients. If one includes all surgery who will be afflicted with some one of these pulmonary complications.

The relative frequency of the various types of conditions that occur and the relation of the conditions to anesthesia may be seen by a study of the chart on page 940 which represents all such complications occurring in the Peter Bent Brigham Hospital in three successive years.

The figures shown reveal a great similarity in the morbidity percentage. The greater fluctuation in the mortality figures is due (1) to a failure in 1919 to eradicate certain cases of old people dying from infection in some of whom the pneumonia was merely a terminal manifestation and (2) to a disastrously large number of fatal embolism cases in 1921. The 5 cases of the latter sequela in 1921 brings the percentage to 0.31 per cent. as compared to Wilson's figure of 0.12 per cent. for 40,449 operations at the Mayo Clinic.<sup>23</sup>

The anesthesia figures show practically the same morbidity after gas-oxygen as ether. The low figure for local anesthesia is not comparable since it is obvious that local anesthesia is rarely employed in septic cases or in abdominal operations which are among the chief predisposing factors to such complications. The lesson which one can draw from the local anesthesia figures is that complications do occur under even the most favorable conditions.

We have already mentioned the linking together by early investigators of anesthesia with these conditions, and even today some hold that aspiration is the chief cause of postoperative

	1918.	1924.	1931.	Totals.
Surgical admissions				
Operations	2032	2033	2080	6135
Pulmonary complications	1562	1604	1590	4756
Deaths from pulmonary complications	55—3.32%	63—3.93%	40—3.08%	167—3.57%
Mortality percentage of nonfatality	11—0.7%	5—0.3%	8—0.5%	24—0.5%
Lobar pneumonia	20%	7 9%	16 3%	14 7%
Bronchopneumonia	4	1	1	6
Bronchitis	21	7	11	39
Emaciation of tuberculae	17	16	6	39
Myocard	8	2	2	9
Pulmonary infarction	2	2	7	11
Pulmonary embolism		32	16	48†
Lung abscess	3	2	8	10
Empyema	2	1	1	4
		1		1
Diets				
Gas-oxy gas-ether	943—3.39%	875—4.6%	856—3.58%	2682—3.85%
Gas-oxygen	495—4.24%	546—3.5%	28—3.58%	2083—3.85%
Narcotics	117—1.63%	179—1.1%	568—2.64%	1609—3.46%
Spiral	5		133—1.95%	449—1.56%
Chloroform	3		1	4
Fatalities				
	4 bronchopneumonia.	1 bronchopneumonia.	1 bronchopneumonia.	
	2 pulmonary embolism	1 lobar pneumonia.	1 lobar pneumonia.	
	1 lung abscess.	2 pulmonary embolism	3 pulmonary embolism	
		1 empyema.	1 lung abscess.	

Pulmonary infarction group not recognized until 1920—most of these cases previous to 1920 grouped as bronchopneumonia.

† Two years only

pneumonia. This has resulted in the unjust term "ether pneumonia." It has been shown experimentally by Hoelcher<sup>22</sup> that under ether coloring-matter in the mouth is aspirated to the lung and by Kelly<sup>23</sup> that coloring-matter placed in the stomachs of anesthetized animals reached the lung when vomiting was induced by apomorphin. Moreover the dye traveled to the side upon which the animal lay emphasizing simple aspiration. It has also been shown that sputum spray probably reduces the local resistance to infection. And Whipple has shown that Group IV pneumococcus known to be carried in a high percentage of normal mouths, is usually present in the pneumonias following operation.

This however by no means proves that the aspiration from the oral cavity causes pneumonia or other pulmonary disease. As a matter of fact, we should expect such sequelae to arise following almost every operation since the above conditions are commonly present. That they are relatively infrequent upsets the theory of aspiration as the chief cause of such complications. Moreover we now know that the most rigorous oral hygiene except in cases of operations within the mouth, has no effect on the instance of such conditions. They occur equally freely among the rich and poor those with perfect teeth or carious ones, and whether the anesthesia is in the most expert or careless hands. It is indeed, one of the most potent arguments against the irritation-aspiration theory that expert anesthetists continue to have such complications.

Embolism and infarction have been proposed as the cause of certain postoperative pulmonary sequelae since fatal pulmonary embolism was first recognized. With the advent of local anesthesia and the observation of these other pulmonary complications following its use in operations this factor was further proposed as the means of their production. We find Gerulanos<sup>24</sup> in 1900 using this mechanism to explain the complications in certain of his cases and a few years previously Mikulicz and Kausch<sup>25</sup> had proposed infarction and embolism as a probable cause in many of these postoperative conditions. Since then there have been many brilliant papers defending the embolic theory of the

etiology of these sequelæ notably by Mikulica,<sup>20</sup> Pietrzkowski,<sup>21</sup> Henle,<sup>22</sup> Gottstein,<sup>23</sup> Ranzi,<sup>24</sup> and Burnham. This theory however is by no means generally accepted. It is defended by (1) the clinical picture of many of these cases with their abrupt onset sometimes immediately following operation the focal signs and unless infection is present, rapid subsidence (2) the fact that these complications occur frequently with local anesthesia and (3) that they occur in a definite relation to anatomic divisions these divisions being those kept in greatest mobility and giving easy access to the lung by blood and lymphatic channels.

The frequency of such sequelæ after abdominal operation has long been recognized.<sup>25-27</sup> Mandl reported 14.5 per cent. complications following celiotomy and in our 1920 cases 43 of the 63 cases with complications followed laparotomy and a proportionat figure is true of the other years. In such cases two sources of embolism and infarction are possible (1) the blood-vessels of the parietes, and (2) the lymphatic avenues (Sabin<sup>28</sup>) Moreover the lesion may occur immediately following the operation, and we have known patients on recovery to complain of severe pain on respiration, to cough up blood tinged sputum and to show a focal area of consolidation demonstrable by the x-ray. The immediate medium for setting free the emboli lies either in manipulations at operation especially the rough use of retractors or in the movements of respiration.

The pathology of pulmonary infarction has been repeatedly described. Welch<sup>29</sup> states that it is not infrequent after operation and gives the clinical signs with which all surgeons and anesthetists should be familiar. We have ourselves carefully studied the lungs of patients who have died from so-called post-operative pneumonia and have been able to demonstrate repeatedly small emboli plugging branches of the pulmonary artery. Furthermore careful x-ray studies have demonstrated the lobular rather than lobar distribution of the lesion, and at times the typical cone-shaped shadow with its base out, has been seen. The more frequent distribution of these lesions in the right lower lobe concurs with the frequency of pulmonary infarction in this region as determined in the autopsy table.

I find there is some hesitancy on the part of pathologists to accept lesions that do not go on to necrosis as infarctions. Therefore, it seems wise to state that I have considered under this heading the pulmonary lesions, with changes in the alveoli and blood-vessels, that follow plugging of a branch of the pulmonary artery. The resultant lesion is certainly more nearly infarction than pneumonia both in etiology and pathology. It is probable that in those cases with prostration and a fairly large area of consolidation a secondary thrombosis follows the original embolus.

The clinical picture induced by infarction is variable and may simulate pleurisy pneumonia or on occasions bronchitis. Pain is usually the first symptom, its appearance being due to the exudate that results at the periphery of the lesion. Pain, therefore may not represent the original lodgment of the embolus but the secondary changes. If the infarct involves a lobule in the center of the lung pain may be entirely lacking and the diagnosis therefore, more difficult to determine. It has been our experience that the x ray is the most informing method in the diagnosis of these conditions. But such studies must be made early since the changes are often temporary variations in blood-vessel size and pressure which soon readjusts itself.

It is thus seen that embolism and infarction can account for fatal pulmonary embolism, bronchopneumonia, pleurisy and lung abscess. That lobar pneumonia occurs as a true complication is probably true. In our experience however it is very rare and in those cases which we have observed there has usually been some special factor in addition, as, for example a story of marked susceptibility with three or four attacks of pneumonia in the past. Dr W. H. Prescott,<sup>22</sup> in attempting to study this aspect of the field in 1895 concluded that ether rarely acted as the exciting cause of acute lobar pneumonia. The abscess cases occur when the embolus is from a septic field, as following tonsillectomy. The pleurisy cases are usually those in which the embolus is small lodges near the periphery and in which the resultant blood-vessel changes cause an exudate that in turn gives a friction-rub with characteristic pain and other clinical signs.

The cases of bronchitis fall into a separate group. It seems

etiology of these sequelae, notably by Mikulicz<sup>3</sup> Pietrzkowski,<sup>4</sup> Henle<sup>5</sup> Gottstein,<sup>6</sup> Ranzi<sup>7</sup> and Burnham.<sup>8</sup> This theory however is by no means generally accepted. It is defended by (1) the clinical picture of many of these cases with their abrupt onset sometimes immediately following operation, the focal signs and unless infection is present, rapid subsidence (2) the fact that these complications occur frequently with local anesthesia and (3) that they occur in a definite relation to anatomic divisions these divisions being those kept in greatest mobility and giving easy access to the lung by blood and lymphatic channels.

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as if most of them were constituted of cases in which there was good evidence of a previously existing lung disorder. This may be a chronic bronchitic or bronchiectatic, an incipient or unrecognized tuberculous lesion, or even a chronic emphysema. We have satisfied ourselves however by the use of routine preoperative and postoperative x ray studies, as well as careful clinical examination that not all such pre-existing disease lights up under the stimulation of operation. It is true that such lesions are more easily stirred up by inhalation anesthesia and it is in this relatively small and benign group that the advocates of the irritation-aspiration theory have their chief support. At the same time we have known such cases to result in active complications when the operation was performed under local anesthesia. And it has seemed reasonable to suppose that should small emboli from the operative field reach a lung already diseased they would bring about sufficient vascular and physical change to stir such a dormant infection into activity.

It is therefore my opinion that the majority of pulmonary complications are due to embolism from the field of operation. The result is either fatal pulmonary embolism or pulmonary infarction. The latter manifests itself typically by its rapid onset, pain, expectoration often blood tinged, elevation of pulse, respiration and temperature, and the signs of a focal consolidation overlain by a friction-rub. These patches are demonstrable by the x ray provided such studies are made at once. The condition is often mistaken for pleurisy or a transient bronchopneumonia. In cases in which a previously existent lung pathology can be deduced, bronchitis or pneumonia may ensue and in some of these cases the direct cause may be the irritation of the inhalation anesthesia plus the aspiration of mouth contents. However it has been shown that in such cases activity sometimes follows when local anesthesia is used.

Anesthesia and anesthetists should not bear the blame, therefore for those complications which are usually due to trauma, sepsis, the mobility of the part, and the resultant embolism.

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## CLINIC OF DR. LINCOLN DAVIS

### MASSACHUSETTS GENERAL HOSPITAL

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#### CASE I. RECURRENT DUODENAL ULCER

J. F. N. No. 248,809 entered the hospital for the third time on March 29, 1922. He was recommended from the Out-patient Department by Drs. H. F. Hewes and Percy Coues, with the diagnosis of duodenal ulcer. He is a single man, fifty years old, who works as a janitor. He has a long and varied surgical history, and the final chapter still remains to be written.

Twenty-eight years ago he had gonorrhea. Thirteen years ago he began to have stomach trouble characterized by pain and distress in the upper abdomen, one-half to one hour after meals and at night, but without nausea or vomiting. The pain was relieved by food. He occasionally noticed that the stools were black. After four and a half years of increasing discomfort from these symptoms and a loss of weight of 20 pounds, he was operated on in another city for ulcer of the stomach, a gastro-enterostomy being done; this was in July, 1914. After operation he was troubled with gas in the stomach and a choking sensation after eating. He felt as if food stuck in his stomach. He lost 25 pounds in the next four months.

He came to the Out-patient Department of the Massachusetts General Hospital in October, 1914, where an x-ray was taken, with the following findings: "Greater part of bismuth leaves by the pylorus, though a small amount appears to pass through the stomach. Media is constricted, apparently by adhesions. Peristalsis is excessive. The first part of the duodenum is dilated and filled with the bismuth mass. At times this mass seems to pass back into the stomach. At others it passes on into the bowel beyond. Stomach empties slowly and there is delay in the jejunum. Patient was unable to take the full bismuth meal."

At another examination it was noted that there was dilation of jejunum next to the stoma, and evidence of obstruction about 2 inches from the gastric opening. The cap was irregular. There was no six-hour gastric residue. Interpretation "Old duodenal ulcer question of obstruction of jejunum. On October 27 1914 he entered the ward and was operated on by a colleague. Many adhesions were found about the duodenum, stomach, and liver. There was no evidence of ulcer of the stomach or duodenum. A posterior gastro-enterostomy stoma was found about 8 inches from the ligament of Treitz, placed aperistaltic with stomach. The stoma was small, admitting the tip of the little finger. This was disconnected, and a thickened appendix removed through a separate incision. The patient's doctor was present at this second operation, and reported that at the original operation he found a mass in the duodenum, causing obstruction just beyond the pylorus. There were enlarged glands along both curvatures and no intra-abdominal adhesions.

For six weeks following the second operation the patient felt well, and he gained 15 pounds in weight. Then gas and distress after meals returned, and he re-entered the hospital on March 30 1915. An x-ray examination at this time showed "Extremely deep and vigorous peristalsis. Constriction of media apparently due to adhesions. Barium leaves stomach by pylorus. There was large ventral hernia in the epigastric scar.

Third operation. Repair of hernia and lysis of extensive adhesions about stomach. After leaving the hospital the patient returned to work, and felt quit well, except for constipation, for nearly seven years.

About six months ago the stomach symptoms began to recur. He had to give up eating meat or solid food on account of distress. There was increasing discomfort after meals with eructation of gas and soreness in the epigastrium. Soda gave relief at times. For the last four months there has been constant pain in the pit of the stomach, day and night. Two weeks ago he was compelled to give up work, as he found that if he

remained quiet he was much more comfortable. There was no vomiting, no blood noticed in the stools no loss of weight. Marked constipation. An x-ray taken in the Out patient Department gave the following findings "Stomach empties in normal time. Peristalsis is active. There is an incisure-like depression in the greater curvature. Barium leaves the stomach entirely by the pylorus. First portion of the duodenum is constantly irregular in outline. The incisure on the greater curvature suggests either adhesions or spasm, and the picture is that of an old duodenal ulcer."

On entrance to the hospital he presented the picture of a fairly well-developed and nourished man of middle age. The chest was negative. The abdomen was negative to palpation except for a thickened and indurated scar in the epigastric region, which was somewhat tender.

Fourth operation, March 30 1922. Liver stomach and intestines buried in dense adhesions. A distinct area of induration with a crater could be felt in the first portion of the duodenum through the adhesions. Stomach and jejunum were partly freed with considerable difficulty and a posterior gastro-enterostomy antiperistaltic with short loop was finally accomplished. The patient made a good recovery complicated by some postoperative cough and superficial sepsis in the wound. He was discharged on April 21 1922 in good condition and apparently relieved.

This case brings up some interesting points for discussion. Granting that this man had a duodenal ulcer at the time of the first operation for which we have the evidence of the original operator the establishment of a gastro-enterostomy although far from a success symptomatically yet apparently accomplished the main object for which it was done viz. cure of the duodenal ulcer. The second operation, some four months later failed to disclose any pathology whatever in the first portion of the duodenum or pylorus. How was this result accomplished? Was there an error of observation? Or was it brought about through a change in the chemistry of the stomach juices as so often alleged or by reason of rest to the ulcerated area by the short circuit established? It would hardly seem that the latter were

likely as an x-ray within four months of the first operation showed that the greater part of the bismuth meal passed through the pylorus, and the stoma at the second operation was found greatly contracted. After restoration by means of the second and third operations of the parts to their original condition as near as possible plus some adhesions, and minus a thickened appendix, we have a period of comparative comfort for seven years followed again by the incidence of symptoms of ulcer the presence of which is confirmed by a fourth operation which restores the original short circuit, with immediate relief. Whether or not this will be permanent time alone will tell. This is truly working in circles.

The case illustrates the fact, which is already well known, though often lost sight of that the results of gastro-enterostomy are beneficent and lasting when there is a chronic calloused ulcer of the duodenum causing obstruction but quite otherwise when the ulcer is small and soft for if such an ulcer heals following gastro-enterostomy without causing constriction or obstruction we then have the condition of a gastro-enterostomy opening in the presence of a normal stomach and duodenum which is well known to be conducive to unpleasant symptoms. Given the latter condition we are faced with the dilemma of either disconnecting the short circuit with the possibility of a recurrence of the original ulcer or of severing and closing the pylorus completely an operation often of some magnitude when the adhesions are dense.

In the presence of a non-constricting small soft ulcer of the duodenum surgical intervention should be held in abeyance until medical treatment has been thoroughly tried out, by which time the ulcer has either healed or has passed over into the calloused and chronic state. The x-ray fortunately usually indicates this point with reliability. If however owing to persistent and severe bleeding or to inability to follow medical treatment it seems necessary to operate on such an ulcer the Finney pyloroplasty with excision of the lesion, offers special advantages or if gastro-enterostomy is done the pylorus should be completely severed and closed by suture with or without excision of the ulcer.

**CASE II. ANNULAR CARCINOMA OF THE RECTOSIG-  
MOID CAUSING OBSTRUCTION RESECTION WITH  
END-TO-END SUTURE.**

A D No 248,553 a telephone lineman forty-one years old married, entered the Massachusetts General Hospital on March 14 1922 recommended by Dr H. C. Marble. The family and previous histories are not important.

On May 14 1921 almost one year ago he was operated on in another city for some acute abdominal condition. According to the patient's story the appendix was removed and some adhesions freed. About two weeks later he was operated on by another surgeon in the same city for obstruction of the bowels. A colostomy was evidently done at this second operation. Since then all bowel movements have been through the artificial anus on the right side of the abdominal wall. He now enters the Massachusetts General Hospital for closure of the artificial anus.

Except for the inconvenience of the colostomy the patient feels quite well. There is no pain and there has been no loss of weight. The man has every appearance of robust health. He has a ruddy complexion and firm muscles. The heart and lungs are negative. In the right lower quadrant of the abdomen there is a colostomy wound with some protrusion of the bowel, from which fecal matter passes freely. There are no masses or tenderness elsewhere in the abdomen. There has been no discharge of fecal matter or gas from the rectum since his second operation. Rectal palpation is negative. Proctoscopy fails to reveal any lesion, although the sigmoid cannot be brought into view. About 1½ pints of fluid could be made to enter the rectum by enema after which severe pain resulted. No fluid could be made to flow through the colostomy opening by rectal injection. Vice versa, no fluid could be made to reach the rectum by injection into the distal loop of the colostomy opening. x Ray after a barium enema showed that barium entered as far as the lower sigmoid none passed this point during a considerable time. There appeared



to be definite obstruction at this point. The Wassermann test of the blood was negative.

A preoperative diagnosis of obstruction of the sigmoid flexure was made. In considering the nature of the obstruction, adhesions were accepted as the probable cause, the general well-being of the patient for a period of a year since the onset of obstruction,



Fig. 358—Case 11. Ra. of barium enema showing obstruction at recto-sigmoid junction.

the absence of loss of weight, and bleeding seeming to definitely preclude cancer.

He was operated on March 21, 1922. A low median incision was made. A hard scirrhous growth of the lower sigmoid lying below the brim of the pelvis and adherent to the bladder was found. The extensive pelvic adhesions were separated necessitating a resection of a portion of the vas deferens. The ureter was not involved in the growth. There was no apparent gland

ular involvement and the liver was free from metastasis. A section of the sigmoid flexure including the tumor mass was resected between clamps with the cautery. An end-to-end suture of the gut was made with some difficulty as the distal segment was short. A rectal tube was passed into the gut beyond the suture line and fastened in place. The wound was closed with out drainage.

The patient made a good convalescence the wound healing by first intention. On April 4th an enema, given by rectum flowed freely from the cecostomy wound establishing the patency of the canal.

On April 8 1922 a second operation was performed for closure of the cecostomy. The cecum was freed from the tissues of the abdominal wall the peritoneal cavity was opened and walled off with gauze packs. The opening in the cecum was closed in layers and covered with omentum and the abdominal wall closed with a small rubber wick for drainage. The wound healed without leakage, and the patient was discharged on April 24th in excellent condition, the bowels moving freely with mild cathartics.

The pathologic report by Dr. H. F. Hartwell on the specimen removed is as follows: "A section of large intestine 12 cm. long. There is a hard tumor mass near one end to which the peritoneal fat is adherent. On section, there is an annular ulcerated growth 4.5 cm. in diameter with raised edges. One end of the incised gut is very close to the growth. Microscopic examination shows the walls of the intestine invaded by irregular gland tubules composed of atypical epithelial cells. There is an extensive fibrosis. Diagnosis: Adenocarcinoma."

The striking feature of this case is that a cancer of the sigmoid sufficiently advanced to cause complete obstruction of the bowels should lay fallow for one year after a colostomy without apparent signs of general ill health, or without evidence of invasion of the neighboring lymphatics or the liver. It would be most unusual to find cancer elsewhere in the body as in the stomach or cervix uteri, which had existed for this length of time without reaching a stage of complete inoperability.

An annular carcinoma of the large bowel is generally regarded

intestinal carcinoma surgically on  
 without obstruction at an early stage.  
 — — — — — and removal. In this case,  
 — — — — — the obstruction was not discovered  
 — — — — — remained fairly well localized and  
 — — — — — the case emphasizes the fact so often  
 — — — — — that the desire on the part of the  
 — — — — — at times often leads to a less complete  
 — — — — — in its malignant nature demands. This  
 — — — — — (from an artificial anus — this was the  
 — — — — — result, alas. I fear in my own. To make  
 — — — — — and suture low in the pelvis the resection  
 — — — — — near the site of the growth, as attested by  
 — — — — — Time will show what the consequences of  
 — — — — — would have been.

CASE III. SCIRRHOUS CARCINOMA OF SPLENIC FLEX  
URR. RESECTION LATERAL ANASTOMOSIS.

M C Hospital No 249,252 a single woman fifty five years old, entered the Massachusetts General Hospital on April 20 1922 She was born in Ireland and is a seamstress by occupation. She has always been in good health Never had any serious illnesses or operations. Occasionally has attacks of constipation and vomiting For the past eighteen months she has been troubled with cramp-like pain all over the abdomen, with gaseous eructations and vomiting There is moderate constipation. No blood has ever been noted in the vomitus or the stools She has lost 30 pounds during the last fifteen months. These attacks of pain and vomiting are followed by periods of remission of symptoms but the attacks are coming at more frequent intervals and now occur every week or so

The patient presents the appearance of a sick woman. Her color is good, but the muscles are wasted and the skin is dry and atrophic. The temperature is normal. Leukocyte count 8800 Red blood-cells 4,200,000 Hemoglobin 70 per cent. Blood pressure 150/115 Heart and lungs are negative The abdomen is flat, flaccid, relaxed, no masses are to be felt anywhere. There is no muscular rigidity there is slight tenderness in the epigastrium. The urine is negative Rectal examination negative

x Ray No 84 417 "Stomach and duodenum low no abnormalities. Barium has not reached cecum in six hours. At twenty four hours barium had reached splenic flexure Transverse colon was dilated showed visible peristaltic waves similar to peristalsis of obstruction seen in stomach. Findings suggest organic obstruction just beyond splenic flexure probably malignant."

Operation on April 25 1922 Left rectus incision. A small hard growth detected at splenic flexure of colon. No adhesions. Very little palpable glandular enlargement. Liver normal. There was marked dilation of the transverse colon, with absence of sacculation The gut was filled with soft putty-like material probably barium. The splenic flexure was resected between clamps

with the cautery. The ends of the severed bowel were closed by purse-string suture and a lateral anastomosis done along the free longitudinal muscle band. Omentum was wrapped about the suture line, and the abdominal wall closed in layers without drainage. Before closing the abdomen an unsuccessful attempt was made to pass a rectal tube up through the stoma; the tube, however, was not sufficiently long to permit of this.



Fig. 359—Case III. Ray of barium meal showing distention and ptosis of transverse colon, with obstruction at splenic flexure.

The convalescence was smooth at first. Gas was passed on the third day and there was no distention. Moderate sepsis of the abdominal wound developed at the end of the first week, and at the end of the second week some fecal material escaped from the wound. The fecal fistula, however, closed within a few days. Normal bowel movements were re-established and at the

end of a month the patient was discharged in excellent general condition, with a small granulating spot at the lower end of the incision



Fig. 360.—Case III. Carcinoma of splenic flexure. Photograph of specimen removed.

The pathologic report by Dr. H. F. Hartwell was as follows: "Section of large intestine 15 cm. long. There is a hard growth at one end which will not admit the index finger. Section shows

with the cautery. The ends of the severed bowel were closed by purse-string suture and a lateral anastomosis done along the free longitudinal muscle band. Omentum was wrapped about the suture line and the abdominal wall closed in layers without drainage. Before closing the abdomen an unsuccessful attempt was made to pass a rectal tube up through the stoma; the tube, however, was not sufficiently long to permit of this.



Fig. 359—Case III. Ray of barium meal showing distention and ptosis of transverse colon, with obstruction, splenic flexure.

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## CLINIC OF DR. W. RUSSELL G. MACAUSLAND

### CARNEY HOSPITAL

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## ARTHROPLASTY AND EXCISION IN THE TREATMENT OF ANKYLOSIS OF THE ELBOW

ANKYLOSIS of the elbow joint even when at the angle most satisfactory for the patient has always very objectional features. Most joints, even though stiff, can still be placed in position to function well, and stiffness, therefore, should always be obtained in the particular position for the highest function.

The shoulder illustrates this point well. For ankylosis it should be placed in abduction 60 degrees, 30 degrees in front of the frontal plane in which position the shoulder motion is obtained at about four fifths normal by hypermobility of the scapular. In the elbow joint, however, ankylosis is usually found in extension of about 160 degrees, in which position the arm is awkward, though not particularly unsightly. In flexion, however, the function may be better but can never approach good function, and it is always very much in the way. Given, then, an ankylosis of the elbow joint from any cause except tuberculosis, some type of mobilization operation may be considered indicated. Resection, which is performed for the tubercular joint in adult patients, is the operation which is usually thought of first. The results from this are very unsatisfactory, the joint being flail, weak, and usually requiring external treatment in the form of a leather with limited elbow joint motion.

Excision, therefore, is rather a crude surgical procedure and the ultimate results from its use do not warrant it being considered for any condition except tuberculosis of the elbow.

For many years the writer has been working to improve the method of procedure in these cases, and has found that with each improvement in the technical procedure a definite improve



an annular ulcerated tumor with elevated margins, 5 cm. long. There are wide margins of uninvolved gut at both ends of it. The mesentery contains a number of small fibrous lymph-nodes. A macroscopic section of the tumor shows irregular gland tubules with high columnar epithelial cells invading the muscular wall, with reactionary fibrosis, and small round-cell infiltration. The tubules are often dilated and filled with mucous material. Sections of eight lymph nodes show only one invaded by small atypical gland tubules. Adenocarcinoma, with metastasis in a regional lymph-node.

In this case the diagnosis depended almost wholly on the x-ray findings. The loss of weight and persistent attacks of colicky pain with alternating diarrhea and constipation should have been sufficient to have aroused suspicion of the true condition, but the absence of any palpable mass and the absence of blood in the stools cast some doubt upon the clinical diagnosis.

The fact cannot be overemphasized that to cure cancer it is necessary to operate on suspicion. In this particular case the x-ray removed all doubt. The case illustrates the insidious nature of cancer of the alimentary tract, and, like Case II shows the comparatively slow growth of certain types of cancer of the large bowel. Although symptoms of the disease had existed for over one year the growth was small and had invaded neighboring lymph-nodes only to a very limited extent.

In my experience lateral anastomosis of large bowel has been very satisfactory and, technically far easier of accomplishment than end to-end suture. If the anastomosis is made close to the closed ends of the bowel there is no trouble with accumulation of fecal matter in the blind ends. In Case II end-to-end suture was obligatory on account of the shortness of the distal segment. Where there is plenty of slack, and especially where there is a large amount of fat adherent to the bowel wall, lateral anastomosis is invariably my first choice. As a rule in suture of the large intestine it is safer to drain the wound. In this case it was not done. Omentum was wrapped about the line of union, and was, I believe the means of preventing disaster for although leakage occurred, peritonitis did not result.

excision, and he wishes to emphasize in this short description the necessity for extraordinary technical care at every step of the operation and after treatment.

*First.* The proper selection of the case. No arthroplastic method should be attempted until two years after an infectious



Fig. 362.—Dissecting out ulnar nerve

process has been quieted down, and at least one year after a traumatic ankylosis.

These two groups include fractures, infectious arthritis, and a few neoplasian joints.

Tuberculosis should be considered entirely in a separate class

ment in the function of the elbow joint motion is obtained, until finally the operation which is at present employed, namely a true arthroplasty has been evolved.

A good arthroplasty gives a smooth gliding joint (so frequently emphasized by the late Dr. John B. Murphy). The

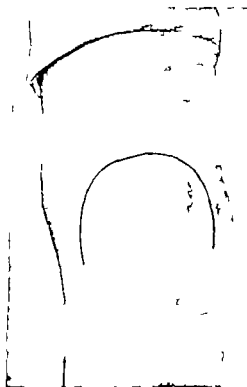


Fig. 361.—Line of incision

range of motion is excellent, the strength approaches normal, the stability is normal, and the joint is painless and tends to stand rather severe work without showing arthritic changes.

To the writer's mind, therefore, the operation of arthroplasty is to be considered in a different place from the old operation of

A semicircular incision is then made beginning over the external condyle running down about 2 inches and up over the internal condyle. The wound is sponged with alcohol and carefully clamped off to avoid handling the skin during the operation. The flap containing skin and superficial fascia is then dissected

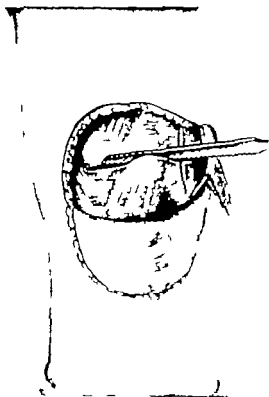


Fig. 364.—Sawing through olecranon tip and end of humerus.

back to the base line and retracted. The ulnar nerve is isolated and dissected out of its sheath. After it has been freed for 2 inches gauze is passed beneath the nerve and it is retracted to the ulnar side.

A transverse incision is then made extending down through

and in only the most unusual case of ankylosis from tuberculosis should arthroplasty be considered.

*Second.* To follow preparation for operation.

*Third.* Strict adhering to the technic of operation.

*Fourth.* Proper after-care.

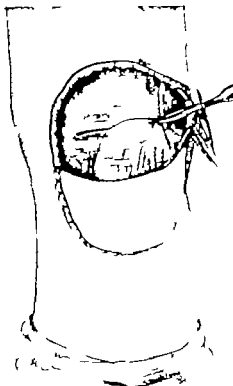


Fig. 363.—Cutting through muscle and fascia to joint.

**Technic of Operation.**—The arm from the wrist to the shoulder and the leg on the same side from the hip to the knee are given a 'two-day preparation'. At the time of the operation a tourniquet is applied to the upper third of the arm and an application of iodine made to the skin.

the joint. The tip of the olecranon has to be chiseled free and dissected back with the posterior flap.

The capsule, fascia, and ligaments are then dissected back so as to allow the lower end of the humerus to protrude into the wound, when its edges are snapped off with rongeur forceps and



Fig. 366.—Cutting out with rongeur forceps bit of olecranon tip left in humerus.

a new two-bulbed surface formed. A shoemaker's rasp is used to shape as nearly like the normal humeral end as possible. Even the olecranon fossa is simulated as closely as possible. One has to be careful about making this cup since extension can be limited by a poorly shaped or placed fossa. This modeling is largely done with a saw and a file.

the periosteum and capsule. This incision follows in direction the superficial one and outlines a flap which is to be dissected back and preserved *in toto* for subsequent covering for the joint. The turning back of this flap is a hard and tedious process, but finally it is well started and may be peeled back readily by

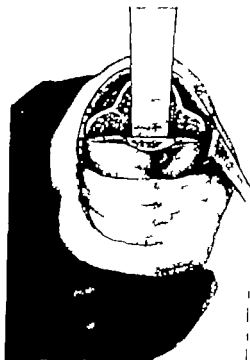


Fig. 363.—Splitting off tip of olecranon with chisel

blunt dissection. The inner side of the joint is the hard part as the layer here is very thin and we must exercise great care not to buttonhole it. The olecranon is then sawed through. After this it is frequently possible to break open the old joint. In some cases, however ankylosis is completely bony and the joint cavity obliterated. Then it is necessary to saw through

loosely around the shaft just below the interrupted suture line.

The forearm is placed in apposition to the condyles. Two drill holes are then made in the olecranon process and two others opposite them in the shaft of the ulna. Through these

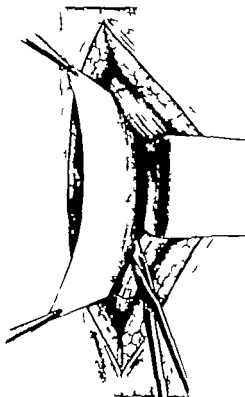


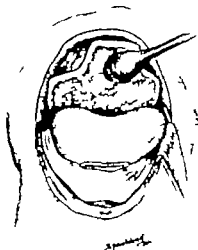
Fig. 368.—Cutting fascia lata from thigh.

kangaroo tendon is passed and tied. The inner layer is now sutured with chromic catgut No. 2 and the skin and fascia with plain catgut No. 2. Dry sterile dressings are applied and the arm put up in plaster beyond a right angle.

**After-treatment.**—If there is no evidence of infection the



To insure good function the joint surfaces should fit accurately before the fascia is applied, but the joint should not be too loose. Only sufficient bone must be removed to give free motion. Remember that if too much of the ends of the bones is removed a flail joint will result, giving the operation no advantage over an excision. When this mortising is completed the fascial flap is dissected from the leg. An incision is made



L.

Fig. 347.—Scooping out ulna and radius with curet.

on the outer side of the thigh a little below the middle extending down to the fascia lata. After a flap of fascia 5 to 7 inches long by 4 to 5 inches wide is dissected out the wound is closed.

This fascia, which is free from most fat, is placed about the newly fashioned humeral condyles and attached anteriorly to the capsule and posteriorly to the periosteum of the lower end of the shaft of the humerus with interrupted chromic catgut sutures No. 2. Chromic catgut No. 2 is then wound twice

In this case a secondary operation should be done to remove this, but it should not be undertaken for at least three months after the original operation. Never force early motion.

Case VII.—E. S. was admitted to the Carney Hospital August 11 1913 for immobility of the right elbow and right knee. Six years previously the patient had had an acute illness accompanied by fever and pain and swelling in the joints for which

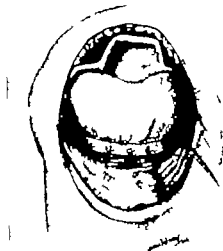


Fig. 370.—Fascia sutured over humerus tied with kangaroo suture.

she was treated in her home, without relief. At the end of eight months the pain and swelling had disappeared from her left shoulder and elbow so that she was able to feed herself, but she remained in bed for twelve months, and after this was in a wheelchair for two years. The symptoms continued to subside on the left side, until at the end of the third year she was able to get about with a cane. As the fever continued to subside and the

cast should remain on for a week. It is then split and the dressing changed. If there is a persistent temperature, a window should be cut in the cast and the wound inspected.

Passive motions are begun in about ten days if normal healing has taken place. The arm is always kept above a right angle. After three weeks gentle massage is applied. Baking is begun in six weeks, three or four times a week.

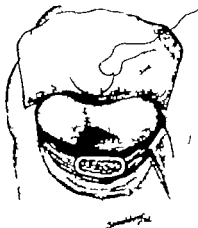


Fig. 349.—Sewing fascia lata to elbow-joint anteriorly.

The ultimate success in these cases depends very largely on the after-treatment. The patients should be under observation for a long period of time. Frequent x-rays should be taken so that we may follow the bony changes in the joint. If motion begins to shut down the arm may be manipulated under an anesthetic and the elbow put up in acute flexion. Occasionally motion becomes limited due to an exuberant growth of new bone.

August 27th the cast was split for dressing

September 1st the wound had healed by first intention except for a slight discharge on the upper border

September 4th daily careful motion begun.

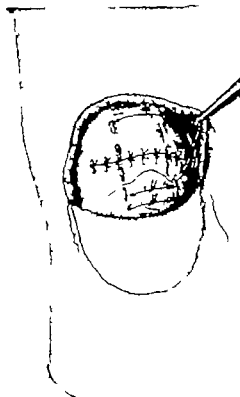


Fig. 372.—Stay sutures.

September 10th the arm could be extended completely and flexed to 15 degrees beyond a right angle

September 15th traction was applied for flexing and extending the arm

October 1st active motion possible

October 15th arm manipulated under ethyl chlorid. Motion

pain and swelling disappeared fairly good motion returned to all the joints except the right elbow and the right knee in which pain and stiffness continued at the end of the fourth year and no motion was possible. This condition continued up to the time

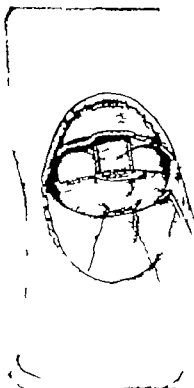


Fig. 371—Kangaroo suture through ulna and olecranon. p

of admission. August 14th roentgenoscopy revealed an ankylosis of the elbow joint (Fig. 373) and of the patella to the femur.

August 20th arthroplasty of the right elbow using flap of fascia lata. A light plaster cast was applied. Following the operation the patient made a good ether recovery. There was slight pain in the elbow.

August 27th the cast was split for dressing

September 1st the wound had healed by first intention except for a slight discharge on the upper border

September 4th daily careful motion begun

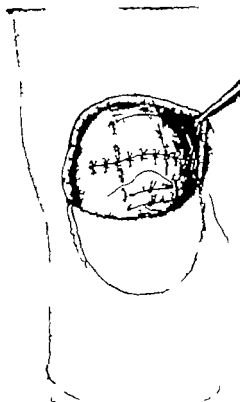


Fig. 372.—Stay return.

September 10th the arm could be extended completely and flexed to 15 degrees beyond a right angle

September 15th traction was applied for flexing and extending the arm

October 1st active motion possible.

October 15th arm manipulated under ethyl chlorid. Motion

free. She was discharged from the hospital May 15 1919 five years and ten months after operation, she writes, "The arm



Fig. 373.—Case VII. E. S. Radiograms showing position of ankylosis before arthroplasty

is doing excellent work. Photographs taken at this time show practically full extension and flexion. See photograph of end-result nine years after operation



Fig. 374.—Case VII. E. S. End-result A, Voluntary flexion B Voluntary extension

To date 45 such operations have been satisfactorily performed 31 of which are published in *Surgery Gynecology and Obstetrics*, September 1921 pp. 223-245

## CLINIC OF DR. TORR WAGNER HARMER

### MASSACHUSETTS GENERAL HOSPITAL.

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#### CERTAIN PHASES OF SURGERY OF THE HAND

- 1 Old Infections and Injuries.
- 2 Tuberculous Tenosynovitis.
- 3 Diffuse Angioma.

DEFORMITY and disability of the hand is often pitiful, not that the condition is unsightly but that it frequently compels the individual to accept employment with a wage scarcely sufficient for himself and family. He may be a skilled workman with a number of years of experience. The calamity comes suddenly. It may be the result of a neglected or maltreated infection or an extensive wound which has severed important structures and has healed without adequate repair. The importance of corrective surgery cannot be overestimated. There are, however, few fields of surgery in which attention to details in after-care plays such an important part in the ultimate result, in which a knowledge of the behavior of tissues (skin, fat, tendon, nerve, bone) is so requisite in which successes are more gratifying or failures more glaring. The foremost consideration in this field of surgery is the prevention of anchoring adhesions and contracting scar tissue. This is accomplished in part by a carefully planned operative attack, by a thorough dissection, by gentle technic, and perhaps by the introduction of fat. It is accomplished in great part by painstaking after-care especially in instituting and supervising *active motion* immediately after operation. For example, even if all the tendons on the anterior surface of the wrist have been sutured, active motion of the fingers is started the day of the operation. If the nerves have also been sutured, however



*extension* at the wrist is prevented by an appropriate splint, but active *flexion* of the fingers and wrist is unrestricted. Immediate active motion not only minimizes the formation of adhesions, but favors the nutrition of sutured or grafted tendons. The prevalent custom of splinting is not rational. The custom survives for two reasons—first, on account of lack of confidence in the method of suture—second, on account of the employment of delayed passive instead of immediate active motion. A method of suture which has been used with satisfaction since 1909 and is thought to be original has been described in detail in two previous communications (Boston Medical and Surgical Journal, December 6 1917 and Surgical Clinics of North America, June, 1921). Suffice it to say here that it is a simple overcasting stitch of silk (or linen) that it permits careful approximation of the tendon ends, that it does not destroy many tendon fibers either by constricting or transfixing and that it will not pull out with early active use. It will not necessarily withstand immediate *passive* motion. Passive motion, however is not an intelligent procedure. It cannot be accurately measured. It is carried out either too gently to prevent anchoring adhesions or too vigorously to preserve tendon approximation. It is, therefore either inadequate or destructive. Active motion, on the other hand, is both efficient and safe. No person will use sutured or grafted tendon too vigorously. A few persons may use opposing muscles too vigorously. Partial restriction of opposing muscles is, therefore rational but any restriction of sutured or grafted tendons is irrational. Appropriate splints are devised to meet these desiderata in each case. For example if the *flexor* tendons at the wrist have been united *extension* of the fingers and carpus may be conveniently restricted by a posterior aluminum splint extending from the finger tips up the forearm bent at the wrist to maintain slight flexion padded with felt, and held in place by webbing buckle-straps attached to the splints. The straps about the forearm and above the wrist may be snugly buckled but the strap across the palm very loosely applied. There should be no strap across the fingers. Such splint will permit full flexion of the fingers and partial flexion of the wrist but will restrict full

extension of the fingers and prevent extension at the wrist. Within a few days the splint may be straightened at the wrist permitting greater extension of the fingers but still preventing extension at the wrist. In case the median or ulnar nerves have been sutured the splint is not straightened for six or eight weeks. Active motion of the sutured tendons is instituted as in any other case but tension on the regenerating nerves by extension of the carpus is prevented.

Before entering upon the consideration of special problems in this field of surgery a brief statement of a few general principles may be expedient. No tourniquet, constricting bandage or cuff is used. In cases of this character the operation is necessarily long. Protracted constriction may not only affect the nerves but the interference with circulation may so disturb the nutrition of the parts that repair processes may be retarded and resistance to infection reduced. Furthermore prolonged use of the tourniquet may be followed by postoperative oozing which is undesirable in work of this kind. Iodin preparation has proved entirely satisfactory. Generous exposure is always necessary. Thorough dissection which frees all involved structures is imperative. The clean cut of a sharp knife is preferable to the crushing cut of scissors. Our *bête noir* is scar tissue. What is found should be removed as far as possible and operative trauma should be reduced to a minimum. The introduction of fat and immediate active movements are valuable preventives but the gentle respectful precise handling of tissues at operation is also very essential. Whether we are dealing with tendons or nerves we must handle them as little as possible. The part may be held once to apply the first stitch. When this is tied it is used as a guy line to steady the part during the application of the rest of the stitch. Although the technic may be criticized, I prefer to hold the structure with a piece of moist gauze in my fingers rather than to subject it to the uncertain compression of a smooth forceps, the bite of a toothed forceps or the tearing of tiny hooks. After the first suture has been placed the structure can be readily handled by it rather than by the use of instruments. I am strongly opposed to any instrument which compresses the struc-

ture during the application of the stitch or during the apposition of the ends in tying together. Further details of technic have already been described in previous communications.

**Preoperative Examination.**—The problem at hand should be determined and the method of attack planned before operation. This demands a detailed examination to make out the integrity of all the tendons, intrinsic muscles, nerves, joints, and bones. Although extensive infections may involve fingers, palm, and forearm for convenience these three divisions are considered separately.

In examining the fingers we are concerned chiefly with the tendons and joints. We should test the movements of each phalanx separately actively and passively in extension and in flexion. We must attempt to decide whether motions are restricted on account of anchoring adhesions, loss of tendon, or joint changes. Is the pathology in the finger itself, or is disability occasioned by pathology in the palm or in the wrist? If the pathology is in the finger itself in what phalanx or in what joint is it situated? It is to be remembered that the chief movements of the fingers are executed by muscles which receive their innervation in the forearm above the wrist. Except in the lumbricales, interossei, and the thenar and hypothenar eminences we do not expect loss of motion from nerve involvement even in extensive injuries to the wrist. The lumbricales, interossei and thenar and hypothenar muscles will be considered with the palm. It is well to remember that in septic fingers the proximal interphalangeal joint is most frequently involved and that the metacarpophalangeal joint is seldom involved.

In examining the palm and dorsum we are concerned not alone with the tendons, but also with the lumbricales, interossei, thenar and hypothenar muscles, and their innervation through the ulnar and median. On the dorsum the problem is usually simpler either anchoring adhesions from involvement of subcutaneous or subaponeurotic spaces or loss of continuity of tendons. In the palm the problem is more complex. We may be dealing with the result of a thenar or midpalmar space infection, with binding of the tendons and the lumbricales which pass into

these spaces. We may be dealing with the result of infection of radial or ulnar bursæ with the involvement or loss of the long flexors of the thumb and little finger. We should test abduction and adduction of the fingers, adduction and apposition of the thumb in order to determine whether the atrophy is due to disuse or loss of innervation. To this end we should try to feel active contractions of the abductor minimi digiti, abductor indicis, and thenar muscles. In actively and passively extending the fingers to determine the condition of the finger tendons as they pass through the palm it may be helpful to carry out the tests with the wrist in flexion and in extension.

In examination of the wrist, in addition to the tendons and carpal bones, we are concerned with the median and ulnar nerves. The problem usually concerns the anterior rather than the dorsal aspect of the wrist. We should have the patient attempt to execute all movements of all the fingers and the thumb phalanx by phalanx, with the wrist extended and flexed. It is wise for the surgeon to steady the joint proximal to the one which is being tested. For instance, in testing the profundus tendons, it is wise to steady the proximal interphalangeal and metacarpophalangeal joints. In testing the sublimis tendons it is wise to steady first the metacarpophalangeal joint and then the meta carpal bone. Let us recall again that ability to flex the fingers does not preclude injury to the median or ulnar nerves at the wrist. The integrity of these nerves at the wrist can be proved only by testing the intrinsic muscles of the hand. Of course, the possible damage inflicted by ruthless incisions in the palm, especially at the base of the thenar eminence will not be overlooked. x Rays of the carpus, hand and fingers are to be taken in all cases following extensive infection or with long-standing contractures from other causes.

**Old Injuries or Infections of the Fingers.**—In old traumata and infections of the fingers our chief problem, as elsewhere, is the liberation of adherent tendon or the bridging of a tendon defect, but it may be complicated by joint ankylosis or inadequately nourished skin. If the deformity is limited to one finger especially if it interferes with the use of the rest of the hand,

amputation may be readily performed under a local anesthetic and the patient will lose but little time from his work. In cases in which several fingers are involved (such as sciving or mangling accidents) corrective surgery must be done. In patients with whom loss of time is not a serious consideration a single finger may be similarly treated. If the skin is well nourished, it may be used to close the wound. If on the other hand it is merely a thin shiny covering firmly adherent to a scar tissue bed, it must be replaced by a skin-and fat graft. One margin of the finger defect may be secured to a flap lifted from any convenient site (abdomen other arm buttock thigh) or the finger may be slipped beneath a bridge of skin and fat. It is unnecessary to state that any tendon reconstruction is useless in the presence of ankylosis of the proximal interphalangeal joint. A tiny arthroplasty is necessary for this joint. Personally I do not think it is necessary as part of the first operation to correct an ankylosis of the distal joint in badly crippled hands. Arthroplasty on the distal joint may be reserved for a subsequent operation. The following case illustrates the necessity of removing thin, shiny adherent skin. A young woman of twenty referred by Dr H. C. Day of Exeter N. H. She had caught her right hand in a mangling machine four months previously. The second, third, and fourth fingers seemed to be nothing more than bones covered tightly with thin, shiny skin on the palmar surface and held in a flexed position by scar. The distal joints of the second and third fingers were ankylosed. Time was an important element and although rather bold it was decided to make three pedicle grafts simultaneously. Accordingly all the shiny adherent covering of these fingers was excised the tendons carefully dissected out, and as much scar tissue as possible removed. Flaps of skin and fat were raised from the abdomen and sutured back into place for revascularization after the method of Blair. The fingers were dressed daily with warm salt solution and about ten days later the wound granulations were removed and the radial borders of the fingers were sutured with silk to the previously raised abdominal flaps. Plaster cast to the trunk and arm with window exposing the fingers was applied. Daily

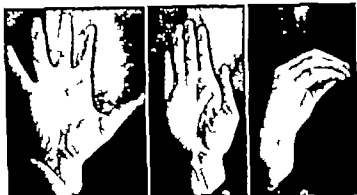


Fig. 375

Fig. 376

Fig. 377



Fig. 378

Figs. 375-378—Mangling accident four months prior to operation, leaving second, third, and fourth fingers in flexion contraction, with ankylosis of distal joint of second and third, and covered on the entire palmar and lateral surfaces with thin skin skin firmly placed to scar tissue bed. Dissection of tendons. Removal of scar tissue. Pedicle grafts from abdomen. Loss of graft to second finger and of subsequent Wolf graft to same finger. Operation in three stages. Pictures taken three months after last operation. (Mass. General Hosp. Records, E. S. 247,076.)

Fig. 375 shows extension and abduction of fingers.

Fig. 376 shows extension and adduction.

Fig. 377 shows apposition of fingers.

Fig. 378 shows abdominal set of grafts.

salt solution dressings were continued, and ten days later the grafts were cut away from the abdomen, trimmed, and sutured to the fingers with silk. The pedicle graft to the forefinger had not survived, and therefore a Wolfe graft to this finger was done. The Wolfe graft died, but the other two grafts took beautifully. After a few days the fingers were done up separately and active motions begun. The illustrations (Figs. 375-378) were taken three months after the last operation. The patient is able to do practically everything, and to strengthen her fingers has been rowing a boat. The perfect correction of the flexion contracture of the third and fourth fingers is well shown. It will be seen, however, that the forefinger in which both pedicle and Wolfe grafts failed shows some tendency to contracture despite the fact that the patient pluckily persisted in active motions throughout the period of granulation and epidermalization. As noted above the distal joints of the second and third fingers are ankylosed. The hand however is very serviceable at present. Should the patient wish it, these joints may be corrected at any time. The above case is given in some detail to illustrate the method of procedure in pedicle grafting. In this case it will be noted that warm salt solution dressings were used. In some cases I believe that dressings impregnated with sterile vaselin are desirable. In any case, the bulk of the dressing is rapidly reduced to a few layers of gauze held not by a bandage, but by tiny tapes loosely tied about each phalanx. This method restricts movements as little as possible.

Figures 379-380 illustrate the use of a piece of the palmaris longus as a graft in the little finger. The patient, a police officer of thirty-one, had been bitten through the little finger five months previously. It is stated that a severed tendon was sutured the following day but 'blood-poisoning' ensued necessitating five days hospital treatment. The finger is held in extension. The distal joint is not involved but cannot be used on account of the absence of the profundus tendon. There is a mass of scar involving the proximal and middle phalanges, but the nutrition of the skin is good. All scar tissue was excised and the tendon graft inserted. Active motions were started at once. The illus-

trations were taken seven months after operation. All the phalanges are now supple flexion of the first two forcible but of the terminal phalanx weak. Apparently there is too much slack in the graft. The finger is very serviceable and the officer has resumed active duty on the force



Fig. 379



Fig. 380.

Figs 379-380.—Severed tendon on little finger (barman bite) followed by sepsis, seven months previously. Finger held in extension. Stiff proximal interphalangeal joint. Good flexion at metacarpophalangeal joint. No flexion at distal joint. Tendon graft from palmaris longus of same arm to repair defect in profundus tendon. Pictures taken seven months after operation. (Mass General Hosp. Records, E. S., 245,069)

Fig 379 shows extension of the fingers.

Fig 380 shows free action at phalangeal joints, flexion at first joint strong at distal joint weak.

Silk bridging to fill tendon defects has been commented on in previous articles. Suffice it to say here that the method has been found particularly serviceable in correcting the deformity from old avulsions of the extensor tendon at the terminal phalanx



Figure 381 illustrates such a case shortly after operation. The scar on the ring finger does not show clearly. Therefore the middle finger has been marked to show the incision used for exposure in these cases. Inasmuch as tendon ends are not approximated but bridged by silk, and inasmuch as the suture occurs on the tiny fringe of insertion I defer active motions in these cases for two weeks.



Fig. 381.—Anastomosis of anterior tendon of fourth finger. Suture anastomosing several weeks prior to operation. Picture taken shortly after operation. Scar indistinct and method of incision for exposure marked on middle finger. (Mass. General Hosp. O. P. D. Records, 264,702.)

Old Injuries or Infections of the Palm.—In old infections of the palm the introduction of fat is a valuable procedure. If the skin of the palm is sufficiently nourished to obviate skin and fat graft I prefer if possible to make incisions for exposure along the natural creases. For instance, a large flap may be secured by making an incision along the ulnar border of the hand which connects an incision along the distal palmar crease and another along the distal crease at the wrist. More often however it is necessary to use a skin and fat graft. This may be in the form

of a pedicle from the abdominal wall or the hand may be slid under a skin-and fat bridge raised from the buttock or thigh. Palmstalking dissection of the structures matted in scar tissue is essential. The dissection should include the lumbricales. If there is no loss of tendon the pedicle graft may be done at once. Whether the skin be raised from the abdomen, buttock or thigh it is wise to split the fat layer leaving a layer attached to the under surface of the skin and making a sheet which is attached along the pedicle of the graft. This sheet of fat is carried beneath the tendons. The fatty layer on the under surface of the skin will then subsequently cover the tendons above. In cases in which the skin of the palm must be grafted and in which there has been loss of tendon substance I believe it is wisest at the first operation to free up all structures and perform a pedicle graft with the introduction of fat as above described. Subsequently the tendons may be grafted. It is unwise to attempt tendon grafting and any form of pedicle skin-and fat grafting at one operation. I believe that the viability of a tendon graft is insured by immediate active motion. Immediate active motion is necessarily impossible with a pedicle graft. To be sure if the hand be slipped under a bridge of fat raised from the buttock or thigh motion of the fingers is possible. Nevertheless, I believe it is wiser to defer the tendon grafting for a subsequent operation. Of course active motions are not prevented by a free skin-and fat graft, but the viability of such a graft causes considerably more anxiety than a pedicle graft.

The same surgical principles obtain in the dorsum of the hand. Figures 382-384 illustrate a case in which a free skin-and-fat graft was applied to the dorsum of the hand in conjunction with tendon grafting. The patient, a man of thirty-three had sustained a mangling accident some months previously. The entire back of the hand was covered by thin, closely adherent skin. The fingers were held in semiflexion. Complete flexion was prevented by the scar on the dorsum. Slight extension of the fourth and fifth fingers was possible. Extension of the second and third fingers was entirely absent. At operation all of the scar of the dorsum of the hand was removed, the extensor ten-



Fig. 382

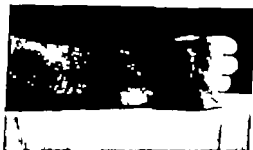


Fig. 383.



Fig. 384

Figs. 382-384—Grafting of palmaris longus tendon to fill defects in extensor tendons of second and third fingers (from knuckles to wrist, performed several months after injury (mangling accident). Fingers had been

dons of the fourth and fifth fingers were freed from scar and tendon defects of the second and third fingers extending from the knuckles to the carpus were repaired by grafts from the palmaris longus of the same arm. The grafts were carried through tunnels made in a free skin-and fat transplant from the abdominal wall. Much of the fat of this graft melted away and a considerable portion of the skin became gangrenous and separated. However active motions of the grafted tendons had been started at once and the tendons survived. The illustrations were made thirteen months after operation and show complete restoration of extension and flexion of the fingers.

The important feature of operations of this nature is the tendon graft. Immediate active use insures the viability of the graft. In the case just related time was an important consideration, and in order to secure immediate active motion a free skin-and fat transplant rather than a pedicle graft was performed. The treachery of free skin-and fat transplants is notorious. I believe therefore it is wiser to divide the problem between two operations: the first, a pedicle skin-and fat graft; the second the tendon graft.

That a considerable lapse of time does not preclude the possibility of success in work of this kind is well illustrated by Figs. 385-387. The patient, a recent graduate of medicine had eight years previously sustained compound comminuted fractures of the second and third metacarpals of his left hand in the gears of a windmill. Septic had ensued. The fingers were subsequently carried in flexion and could be but feebly extended. At operation the tendons were found buried in scar tissue adherent to bone

carried in flexion. No power of extension in second and third and very slight in fourth and fifth. Picture taken thirteen months after operation. Thin, glossy, adherent skin removed from greater part of dorsum of hand. Extensor tendons of second and third fingers found missing through full length of metacarpals. Extensors of fourth and fifth fingers freed from scar tissue. Grafts from palmaris longus were run through tunnels of fat in free skin-and-fat graft from the abdomen. Most of the fat melted away. Considerable portion of skin became gangrenous and separated. Tendon grafts, however not affected. (Mass. General Hosp. Records, E. 5 235,490.)

Figs. 382 and 383 show extension and flexion of fingers

Fig. 384 shows incision for removal of palmaris longus.



Fig. 383



Fig. 385



Fig. 387

and distorted by exostoses. The exostoses were removed the tendons freed and those of the second finger shortened. He has a perfectly serviceable hand. The pictures taken ten months later (Figs. 385-387) show extension and flexion of the fingers. Figure 387 shows that further shortening of the index tendons at the time of operation would have been desirable for complete extension of this finger cannot be accomplished. The difficulty of exactly estimating the length of a tendon be it shortened or lengthened or grafted, is well known to all who have worked in this field.

Figures 388-390 illustrate another problem, securing active motion of sutured tendons in the presence of fracture. The patient, a lad of seventeen had several hours previously nearly amputated his left thumb with an axe. Only part of the thenar eminence (including the flexor longus pollicis) remained. At operation the first metacarpal was found to be cut cleanly and very obliquely. An effort was made to hold it together by suturing the periosteum and adjacent muscles with catgut. The severed muscles were repaired and the tendons of the extensor longus pollicis and extensor brevis pollicis were sutured. It was found that a right angled splint placed between the forefinger and thumb (holding the thumb in abduction) best maintained alignment of the bone fragments. The thumb-piece of the splint was extended only to the phalangeal joint. In this way active motion of the extensor longus was immediately possible. The illustrations (Figs. 388-390) taken seven months after operation show

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Figs. 385-387—Old compound fractures of metacarpals with severed extensor tendons. Shortening of extensors of second finger and suture of extensor of third finger performed eight years after injury (compound fractures of second and third metacarpals from crush in gears of windmill). Since this time the second and third fingers had been carried in flexion. Pictures taken ten months after operation. Tendons found buried in scar tissue and adherent to metacarpals. Impossible to distinguish between extensor carpi ulnaris and extensor indicis. Both fused in scar adherent to bone and distorted by exostoses. Exostoses removed, tendon shortened. Tendon ends of third finger liberated from scar and sutured.

Fig. 387 shows some limitation in extension of forefinger due to little or much slack in the tendon. Further shortening at time of operation would have been desirable.



Fig. 385



Fig. 386

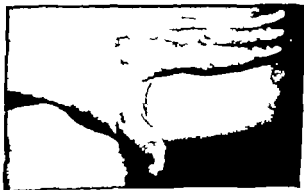


Fig. 387

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Fig. 387 shows some limitation in extension of forefinger due to little too much slack in the tendon. Further shortening at time of operation would have been desirable.





Fig. 388

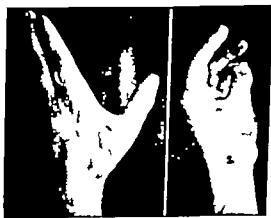


Fig. 389

Fig. 390.

the original wound and the extension for operative exposure. The result is not perfect. There is slight deformity at the site of fracture. Function of the hand is not impaired and he has resumed work in an iron foundry.

**Old Injuries and Infections of the Wrist and Forearm.**—On account of the compact arrangement of the structures on the anterior surface of the wrist, especially beneath the annular ligament, wounds or infections extending from radial or ulnar bursa may be very damaging. Another serious sequel in extensive infections is the invasion of the carpus. If this calamity has occurred it is best to deal with it first. All the carpal bones should be removed and the interval filled with fat. In dealing with the nerves and tendons, wide exposure is imperative extending from the base of the palm up the forearm and dividing the annular ligament. Great care should be taken to free up all the structures. A pedicle flap from the abdomen is raised and the fat layer separated, so that a layer may be interposed between the profundus tendons and the pronator quadratus, another between the deep and superficial tendons, and a layer adherent to the skin to cover the latter. Nerve and tendon suture or tendon lengthening to bridge a small defect may be done at the same time. However if the tendon defects are extensive it is wiser to defer tendon grafting and nerve anastomosis for a second operation. If there has been loss of nerve substance end-to-end anastomosis should be secured by extensive freeing up of the nerve. If the nerve defect is great, however especially if associated with tendon loss it may be wiser to resect the lower ends of the radius and ulna.

Figs. 388-390.—Thumb almost amputated with an axe several hours before operation, cutting the metacarpal, the extensor longus and extensor brevis pollicis, and muscle belly of abductor pollicis. Sutures of periosteum and surrounding tissues to hold bone fragments. Primary suture of extensor tendons. Closure without drainage. (Mass. General Hosp. Records, E. S. vol. 1602, p. 103.)

Fig. 388, -ray of hand immediately after accident, shows clean-cut oblique fracture of first metacarpal. The fracture was complete, although the -ray does not give this appearance.

Fig. 389 shows action of extensor tendons.

Fig. 390 shows position of thumb, original U-shaped wound, and operative extension.

to secure end to-end anastomosis rather than depend on a fascial or vein intubation of the separated ends. I have not yet encountered this problem but my conviction is so strong that end-to-end anastomosis of nerves is the only rational method that I believe I should resort to bone resection to accomplish it.

Diffuse tuberculous tenosynovitis of the wrist in the absence of secondary infection or joint involvement, may be successfully treated by complete excision. This method of treatment is especially applicable to cases of not too long standing. Wide exposure including division of the annular ligament and careful dissection are demanded. In the case here illustrated a flap the width of the wrist was turned back. The transverse incision was made in one of the natural creases and an incision at right angles to it carried into the palm divided the annular ligament. The cosmetic effect has been very good. A single midline incision however is adequate in less extensive cases. The patient a stenographer referred by Dr F G Smith of Somerville, Mass., presented on the anterior aspect of the wrist a tensely fluctuant rounded mass involving two-thirds of the width of the wrist and extending distally beneath the annular ligament into the palm. Symptoms began four months previously with gradual increase in weakness of the wrist, and especially in flexion of the thumb and middle finger. The incision as above described and as shown in the illustrations (Figs. 391-394) permitted thorough dissection. As is usual, the fascia was closed separately with silk. Active motions were started promptly. The illustrations taken seven years after operation show complete cure and no limitation in any motions of the fingers thumb or wrist.

Diffuse Angioma of the Wrist.—Diffuse multiple angiomas of the hands are not rare but a diffuse mass of angiomatous tissue plexiform in character resembling somewhat chroid aneurysm must be very unusual. I have never seen but one case and have recorded it here because it extended down and worked its way in through and around the great mass of tendons of the wrist extending as shown by the black lines on the illustrations which mark the length of the incision from the proximal part of the dorsum of the hand, beneath the posterior annular



Fig. 391



Fig. 392



Fig. 393

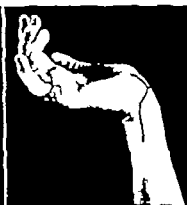


Fig. 394

Figs. 391-394.—Extensive tuberculous tenosynovitis involving anterior aspect of wrist and extending beneath annular ligament into palm. Operation four months after onset. Pictures taken seven years after operation. Lines of incision marked in ink.

Fig. 391 shows extension of fingers.

Fig. 392 shows extension of wrist and fingers.

Fig. 393 shows hyperextension of wrist.

Fig. 394 shows hyperextension of wrist.

ligament, more than one-third way up the forearm. The patient had had some previous treatment which had resulted in an extensive slough which had healed by granulation. This is well shown in Fig. 395. The patient, a young woman in her twenties, was referred by Dr. E. H. Wells of Wakefield, Mass. The dorsum of the wrist presents a soft rounded swelling covered by very thin skin and extending from the posterior annular ligament



Fig. 395.

Fig. 396.

Fig. 397.

Figs. 395-397.—Diffuse angioma of dorsum of hand and wrist, plantiform in character insinuating itself by finer and coarser ramules between and around the extensor tendons, beneath the annular ligament on to the dorsum and one-third way up the forearm. Pictures taken six years after operation.

Fig. 395 shows pre-existing area of this skin (see text), extent of incision, and complete extension and abduction of fingers.

Fig. 396 shows flexion of fingers.

Fig. 397 shows forced extension and adduction of fingers.

about one-third way up the forearm. Compression of the forearm above this mass increases its size and the intensity of its blueness. It also brings out swelling on the dorsum of the hand and to the ulnar side of the forearm. The skin in these situations, however, is normal and no discoloration appears. Under ether anesthesia an incision was made over the summit of this discolored mass and distally on to the dorsum of the hand through



Fig. 398.

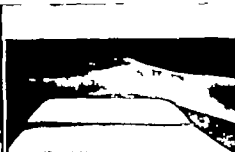


Fig. 399.

Figs. 398, 399 — Lacerated wound of ulnar side of wrist severing tendon some months previously. Operation done elsewhere, with fair result, but tendons are herniated through the fascia and adherent to the skin. Limiting flexion and extension of the third, fourth, and fifth fingers. Excision of previous scar. Freeing of tendons. Tendon suture. Separate closure of fascia. Immediate active motion. Pictures taken two months after operation show complete flexion and extension of fingers.



Fig. 400.



Fig. 401.



Fig. 402.

Figs. 400-402 — Lacerated contused wound of wrist (crush) with severance of flexor carpi ulnaris several hours before operation. Debridement. Exploration of ulnar nerve shows it to be intact. Suture of flexor carpi ulnaris. Primary closure. Immediate active motion. Pictures taken six months after operation. (Mass. General Hosp. Records, 244,106)

Fig. 400 shows abduction of wrist.

Fig. 401 shows adduction of wrist.

Fig. 402 shows line of incision, flexion of fingers.

the annular ligament and a short distance proximally. The dissection involved practically the entire back of the wrist and

lower forearm. It was extremely bloody. There were many tortuous vessels of vein-like character with relatively resistant walls. There was however also an extensive lacey cobwebby mass insinuating itself with these coarser sinuses between and around the tendons, beneath the annular ligament, and on to the dorsum of the hand. On account of the bloody character of the operation immediate active motions seemed indiscreet, and the hand and forearm were held in extension on a splint for over a week. At the end of this time a few active motions were started. Now six years after operation there is no limitation of any movements of the fingers, thumb or wrist. Figures 395-397 illustrate the condition at present and show the pre-existing area covered with thin skin and the extent of the incision.

## CLINIC OF DR. WYMAN WHITTEMORE

### MASSACHUSETTS GENERAL HOSPITAL

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#### TWO UNUSUAL CASES OF EMPYEMA

THESE 2 cases of empyema are very unusual and are so unlike the ordinary acute empyema that it seems well worth while to show them.

The first case is a man forty two years old W S 247,925 who entered the Massachusetts General Hospital February 10 1922

*Family history and past history* were unimportant.

*Present Illness*—He had been very sick for five weeks with pneumonia. Two weeks before admission he seemed to be improving, but then became much worse and one week ago he was seen in consultation by Dr J B Hawes. At this time a diagnosis of empyema was made, but the patient was considered too sick to stand the trip to the hospital. He was given digitalis and supportive treatment until his general condition seemed good enough to warrant moving him to the hospital. A Ray taken in the Emergency Ward showed two areas one at the right apex and the other at the right base of what was believed to be encapsulated fluid (Fig 403)

Physical examination was entirely negative except for the following points. Chest very thin. Right side moves very little with respiration. Lungs. Many coarse rales over left, but otherwise resonant on that side. There was marked diminished resonance, almost flatness, over the right apex and below the seventh space behind. Breath sounds were diminished over the entire right side, but practically absent at the base and apex. Tactile fremitus and voice sounds were also absent over these areas. Heart was displaced a little to the left. The rate was



rapid and the sounds were only of fair quality. There was a decubitus ulcer over the sacrum. The patient was emaciated and gaunt, slightly cyanotic and breathing with obvious effort. White cell count, 19,000 red count, 3,720,000. Urine was negative.

Fluoroscopy showed the whole right chest less radiant than the left, but not dull except at the apex, which is opaque. There

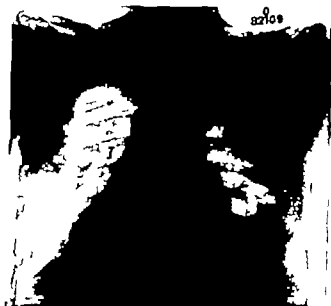


Fig. 40. —Encapsulated fluid at apex and also base of right chest.

was also an area of dulness at the right base just above the diaphragm, dullest at a point just above the middle of the dome where the dulness is nearly circular as seen from the front. It seems to approach nearer the anterior wall of the chest, and when the patient is turned toward the left side the dulness tends toward the right periphery in widening shadow. The right axillary border also appears dull, but not completely opaque. The diaphragm is seen distinctly below the dulness in the lung.

field. Excursion limited on both sides. Action rapid. Costophrenic angles clear. Plates are confirmatory. Findings are probably due to encapsulated fluid in the region of the right apex and also in the right lower chest. In the lung area between the two areas of encapsulated fluid there are mottled shadows suggesting bronchopneumonic patches.

He was coughing a great deal and at times raising a considerable amount of pus, which showed streptococci and influenza bacilli predominating. Wassermann negative.

He was in such bad condition it seemed wise to deal with only one encapsulated area at a time. Aspiration was done in the eighth space in the posterior axillary line and 5 c.c. of thick green pus obtained. The following day February 11th, under local anesthesia (novocain 1 per cent.) a trocar-catheter drainage operation was done the catheter being put in through the eighth interspace. Culture of pus showed pneumococci.

Three days later February 14th the patient's condition being somewhat better but temperature ranging from 98° to 101° F. thoracentesis was done in the fourth interspace in the anterior axillary line and the needle was pointed directly upward toward the apex. A cavity containing pus was encountered at about the level of the first rib and 40 c.c. removed. Culture showed streptococci.

Operation (February 16th) Third rib in anterior axillary line resected under local anesthesia (novocain). The lung was found to be very adherent to the parietal pleura and was carefully freed with the finger. At the level of about the first rib a small cavity containing pus was opened. This was drained with a large rubber tube.

Following this operation his cough quickly stopped, improvement was steady and temperature remained practically normal during the remainder of his stay in the hospital. Both cavities were treated with Dakin's solution. On March 1st, eighteen days after his trocar-catheter thoracotomy the lower cavity was sterile and the catheter was removed. Drainage from the upper cavity continued but was small in amount. On March 19th the patient was discharged with the upper tube

still in place to have salt solution irrigations at home. He reported to me on April 20th entirely healed having gained 20 pounds and looking very well.

The two interesting points in this case are first the presence of two encapsulated empyemas, which I believe to be a very rare condition, and second that the organism in one cavity was a pneumococcus and in the other a streptococcus.

The second case is a man thirty-eight years old, W. S., 247 890 who was admitted to the Medical Wards of the Massachusetts General Hospital on February 9 1922 with the diagnosis Bronchitis and pleurisy (probably tuberculous)

**Family History**—Nine brothers and sisters died in their infancy in Italy. No history of tuberculosis. No bleeders in the family.

**Marital History**—Married eleven years. Wife and one child living and well. No miscarriages or stillbirths.

**Past History**—He has been working for five years in a poorly ventilated candy factory but before that was a laborer.

His health has always been excellent and he has never had any serious illness. There has never been any abnormal bleeding.

**Present Illness.**—Eighteen days ago the patient became ill with what he thought to be a head cold. The following day it descended into his chest and he began to cough a great deal. For the first week cough was unproductive but since then he has been raising a small amount of yellowish white sputum which was sometimes blood streaked. No real hemoptysis. He has had profuse night-sweats during present illness, but never previously. He has had three attacks of pain in the chest, one fourteen days ago one six days ago and the third two days ago each one lasting about two days. Pain was right sided knife-like and radiated both front and back. He has lost strength and appetite during illness and thinks he has lost a good deal of weight.

**Physical Examination.**—Negative except for the following points:

**Chest.**—Expansion greater on the left.

**Lungs.**—There was dullness at the right apex, with squeaking rales and increased whispered voice and flatness in lower right,

in front. At the right base behind there was also flatness with diminished whispered voice and vocal resonance. In the infra scapular region on the right there was slight dullness, with bronchovesicular breathing and diminished whispered voice.

*Heart*—Apex impulse fifth space 10 cm. to left. Sounds regular but of distant quality. Second sounds equal and not accentuated. Left border percussed 5.5 cm. outside the nipple line. Right border 3.5 cm. Blood pressure 130/90.

*Abdomen*—Much voluntary spasm. Liver edge just felt. Otherwise negative.

There was slight clubbing of the fingers of the left hand, but none on the right.

*Urine* was negative except for slight trace of albumin. *White count* was 33,000 with 89 per cent. polys. *HGB* 95 per cent. *Sputum* was thick and purulent, with much pus and many Gram-positive cocci and moderate number of Gram-positive bacilli. *Stool* was negative. *Blood-culture* was negative.

*Fluoroscopy* showed hilus shadows and lung marking in creased. On the right side the costophrenic angle was very hazy and on that side movement was practically obliterated. Near to the base of the right lung there was a characteristic shadow with horizontal border which shifted with the patient's change of position and rippled on agitation. Above this area was another bright area separated by normal appearing lung structure. The upper bright area was smaller than the lower one but also showed a fluid level. There was a dense shadow in the axillary line connecting the two areas. Plates confirmed the fluoroscopy examination, showing two areas of encapsulated fluid with gas above each fluid level (Fig. 404).

*Chest tap* in the seventh and eighth spaces in the posterior axillary line was dry.

After remaining on the medical service for five days during which time he ran a septic temperature from 99° to 102° F. he was transferred to the surgical side for operation.

February 15th. Operation under local anesthesia (novocain 1 per cent.) A section of the fourth rib in anterior axillary line was removed. Two empyema cavities were found communi-

cating with each other by means of a small sinus. This was enlarged and a large rubber tube was placed in the lower one, and a small catheter was placed through the sinus into the upper one for irrigations.

Smear from the pus obtained at operation showed many diplococci, but culture showed staphylococci.

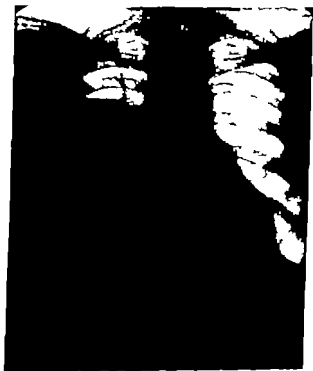


Fig. 404.—Two fluid levels in right chest.

After operation his temperature was lower. He coughed very severely the cough being paroxysmal 4 times. Cavity irrigated with Dakin's solution every two hours.

Five days after operation the patient had a shower of petechiae scattered all over the body but especially marked about

the left knee and elbow. The blood-picture was normal except for a moderate leukocytosis and secondary anemia. Clotting mechanism was apparently normal. Three days later the patient complained of a good deal of abdominal pain and passed a stool containing a considerable amount of bright blood and the



Fig. 405.—Same case as Fig. 404, showing irrigation tubes in place.

following day he had another small hemorrhage. With each of the hemorrhages he went into shock with low blood-pressure, temperature and high pulse. He continued to run a septic temperature with long daily swings. On March 3d his left elbow became swollen and painful on motion. There were signs of unresolved consolidation at the right apex and some peri

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## CLINIC OF DR. EDWARD P. RICHARDSON

### MASSACHUSETTS GENERAL HOSPITAL

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#### GASTRIC ULCER; HEMORRHAGE; EXCISION; REPEATED TRANSFUSIONS; POSTERIOR ANTECOLIC GASTRO-ENTEROSTOMY

THIS patient, No 245 769 male sixty-five, widower manager of a dance-hall, was sent into the emergency ward of the Massachusetts General Hospital with a diagnosis of gastric hemorrhage. Ten years previously he had been explored in this hospital under a diagnosis of duodenal ulcer. A slight induration of the duodenum close to pylorus was found with stippling but the condition was considered insufficient to justify gastro-enterostomy. The appendix was removed. While his condition was somewhat relieved by operation, some digestive disturbance persisted. For a year he has suffered from epigastric distress without definite relation to meals, but not of sufficient severity for him to seek relief. Two days before entrance while taking a cup of tea he felt nauseated and vomited black material containing streaks of blood. Vomiting of blood continued, how much is not known but apparently he had vomited a large amount of new and old blood. He had difficulty in telling a coherent story, looked sick, and seemed mentally retarded. Examination showed a markedly anemic man with considerable emaciation. Otherwise the findings were essentially negative. His teeth were carious with marked pyorrhea. The abdomen presented a well-healed epigastric scar. There was no spasm or tenderness.

All feeding by mouth was stopped. He was given morphin to check peristalsis, and water and glucose solution (5 per cent.) by rectum. Bleeding continued and his general condition failed. Two days after admission he was transfused, 750 c.c. of blood being given by means of Vincent's paraffined glass tubes. This



cardial effusion. There was a loud systolic murmur and thrill and rapid rate, suggestive of acute endocarditis. Second blood-culture showed presence of staphylococcus.  $\times$  Ray showed signs of incompletely expanded lung on the right and some unresolved consolidation.

Patient continued to run a septic temperature and early in April he developed a tender and painful left shoulder joint, which gradually subsided. Sinus continued to discharge a good deal and irrigations were continued. Septic temperature continued through most of April, but patient was allowed to sit up and he gradually gained a little in strength.  $\times$  Ray showed that there was no more fluid present in chest and that low-grade consolidation was gradually resolving (Fig 405) Blood-culture was negative. Symptoms in elbow and shoulder subsided and temperature came down somewhat, although it did not remain flat. During stay in hospital very marked clubbing developed in both hands and feet, but much more marked on fingers of left hand.

The patient was discharged on May 3d to have irrigations continued and dressings done at home and in the emergency ward. Since leaving the hospital general condition has improved markedly although wound is still discharging. Patient is up and about and gaining weight and strength.

There are several interesting points in this case. First, the presence of two fluid levels in the pleural cavity and yet the two cavities communicated with each other by means of a small sinus that was found at operation. Second, the fact that the patient had staphylococcus septicemia that cleared up. And third the occurrence of hemorrhages in the skin, intestines, and two joints. His left arm at one time was tremendously swollen, edematous, and his elbow and shoulder joints were extremely tender. This condition cleared up without any treatment except rest.

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resulted in a marked improvement in his condition. Operation was not immediately undertaken, as it was thought possible he might improve further. Hematemesis and tarry stools continued, however so that in two days his condition was as bad or worse than at entrance.

Gastric analysis and x ray were not done on account of the active bleeding. The source of the hemorrhage was thought to be a chronic gastric or duodenal ulcer. Bleeding from a ruptured esophageal vein accompanying cirrhosis of the liver was thought of but there was no confirmatory evidence. The possibility of bleeding from erosions of the gastric mucosa, or from the stomach without definite gastric lesion, as may occur secondary to abdominal disease elsewhere for instance of the gall-bladder or spleen, was also considered. However in view of the patient's age, epigastric distress, previous operative history and the persistence of active bleeding in spite of transfusion the most probable diagnosis was chronic ulcer of the stomach or duodenum with bleeding. Since it seemed clear that death from hemorrhage would occur unless there was interference operation was decided on. Four days after entrance, and two days after transfusion, he was again given 750 c.c. of blood, and the abdomen opened under local anesthesia with novocain.

Exploration of the stomach showed a small indurated ulcer of the lesser curvature near its middle. Ether was then given by the drop method. The ulcer was excised, and the opening in the stomach closed transversely with two layers of chronic gut, reinforced by suturing the fatty tissues of the lesser omentum over it. A slight induration of the duodenum anteriorly was felt, not definite enough to regard positively an ulcer. The patient stood operation well, but it was not thought wise on account of his condition to add a posterior gastro-enterostomy. The Balfour cautery operation was not done on account of the limited size of the ulcer and a desire to demonstrate beyond question, the source of the hemorrhage.

Pathologic examination showed a shallow circular ulcer of the mucous surface 2 cm. in diameter with a small perforated blood-vessel at its base. Microscopic examination showed the surface

of the ulcer covered with exudate. There was fibrosis of the base extending through the muscular coat. There was no atypicity of the gland tubules at its margin.

Following operation his condition was satisfactory. Nourishment was taken well, and there was no evidence of active bleeding although his stools were dark and gave a positive guaiac reaction. On the tenth day his hemoglobin was 35 per cent. his red cells 1,375,000. On this day he had two fainting spells followed by tarry stools. He improved, but his stools still contained blood. On the sixteenth day his hemoglobin was 20 per cent. and his condition serious. Transfusion of 750 c.c. of blood brought about immediate improvement, which was maintained for many days. Slow bleeding continued, however as shown by blood in the stools. On the twenty seventh day his hemoglobin was 35 per cent. and his red cells 2,110,000. A week later he began to complain of epigastric distress, and it became increasingly difficult for him to take nourishment. After being at a standstill for so long he was obviously slipping and further operation became imperative. Last night on the morning of the forty second day he was transfused again with 500 c.c. of blood. He shows a very definite improvement although still anemic. His condition is now good enough for a reasonable operative procedure. We have now to explain his persistent slow hemorrhage and his more recent epigastric distress. It is reasonable to suppose that these are due to a recurrence of the ulcer, a failure of union at the suture line after excision, or to some lesion previously overlooked.

Ether has been given by the drop method. I open the abdomen to the left of the old median epigastric incision hoping to avoid in part entering adhesions. The peritoneal cavity is free except for a few light bands. Palpation of the stomach shows at once a large crater-like defect in the posterior gastric wall, 1½ inches in diameter. The symptoms are at once explained. There is a large gastric ulcer adherent to the pancreas and easily felt through the anterior stomach wall. How did this ulcer get there? There are two possibilities. Part of the suture line in folding the original ulcer of the lesser curvature, may have given

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this case to save time. The ulcer is closed with a continuous chromic suture the edges being approximated so that the suture line is transverse to the long axis of the stomach. This line is inverted with a second row of interrupted suture. Near the greater curvature this is easily done but at the upper end the stiffening and adhesion of the lesser curvature make satisfactory inversion difficult. Closure here cannot be considered entirely satisfactory. On this account the omentum is turned upward between the stomach and pancreas, and caught with sutures to the retroperitoneal tissues in the region of the lesser curvature this reinforcing the whole suture line and also preventing it from readhering directly to the pancreas as well as covering and walling off the ulcer base.

The patient still remains in fair condition and in view of the previous experience following suture of the ulcer alone gastro-enterostomy seems advisable. The ordinary posterior gastro-enterostomy cannot be done since the stomach would have to be brought through the omentum and the transverse mesocolon to meet the jejunum. The fixation of the stomach and the limited area of posterior wall available for suture will not permit this. Anterior gastro-enterostomy can easily be done but will bring the intestinal loop under the operative scars in such a position that adhesions are sure to occur and partial obstruction of the loop with vomiting is likely. Placing the omentum which is rather short and thick, behind the stomach has pulled the transverse colon up and back and allowed the stomach to drop forward a little so that it overlaps the colon anteriorly thus exposing the posterior gastric wall. On bringing the jejunum to the stomach in front of the transverse colon the union which seems to promise the best function as the parts lie is an anastomosis of the jejunum to the posterior wall of the stomach to the left of the suture line. Here it happens to lie naturally from right to left without danger of involvement in adhesions between the stomach and abdominal wall. This union can be described as a posterior antecolic gastro-enterostomy. A somewhat longer loop of jejunum is necessary than for the usual posterior operation. Suture is done with 00 chromic catgut throughout to avoid favor



away. If so, why is the ulcer now on the middle of the posterior wall? The opening remaining to be closed after excision of the gastric ulcer is always larger than one expects. In closing such an opening transversely the suture line extends quite far on to the posterior wall of the stomach. If the posterior part of such a suture line should give away the result would be an opening in the posterior wall of the stomach. The absence of peritonitis could be explained by adhesion of the gastric wound to the pancreas.

The other possibility is that interference with the gastric circulation due to ligation of vascular branches in the neighborhood of the ulcer led to delayed healing and a recurrence of the ulcer in the region of the suture line, or trauma to the vessels and stomach wall, favored by the patient's anemia and low resistance may have led to thrombosis and a limited necrosis.

At any rate we have the large ulcer. What should we do about it? Gastro-enterostomy alone will not serve, since it is not at all certain to check the slow bleeding. The ulcer must be attacked directly. We cannot reach the ulcer above the stomach, because the lesser curvature is densely adherent to the liver in the region of the old excision. The ulcer must be attacked by dividing the gastrocolic omentum and entering the lesser peritoneal cavity between the stomach and colon. A wide opening is made here. The posterior gastric wall is extensively adherent to the pancreas. By slow dissection, turning the stomach up and back, it peels off the pancreas and retroperitoneal tissues. After a short distance there is leakage of stomach contents. The reason becomes clear. The gastric wall is completely gone and the base of the ulcer is formed by the pancreas. The stomach is dried out, and the dissection carried higher until the gastric wall is freed from the pancreas. The upper margin of the ulcer is particularly difficult to free from adhesions along the lesser curvature. The ulcer is now completely exposed. Its diameter is nearly 2 inches, the margins are abrupt and only slightly indurated, except along the lesser curvature. Excision of the ulcer margins and excision or cauterization of the ulcer base formed by the pancreas are usually advisable but can be neglected in

The third point is the use of a posterior antecolic gastro-enterostomy instead of the usual anterior operation. Under conditions when it is not practicable to perform the posterior operation the ordinary alternative is an anterior gastro-enterostomy. When anterior gastro-enterostomy is done as a secondary pro-

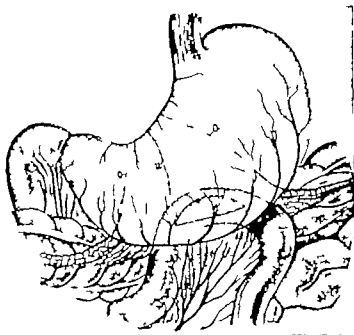


Fig. 406.—Schematic diagram, showing condition of first case of posterior antecolic gastro-enterostomy at the close of operation. *U* Sutured scar of posterior wall. *O* omentum, holding colon high like second mesentery. *J* jejunum brought in front of colon and anastomosed to posterior gastric wall.

cedure is when adhesions are likely to form between the stomach and abdominal wall. The jejunal loop lying between the stomach and abdominal wall may become involved in these adhesions. Under these conditions it may function badly, leading to persistent vomiting and possibly to further operative procedures. It cannot be considered an entirely satisfactory type of operation.

ing the formation of gastrojejunal ulcer by use of unabsorbable sutures. A few sutures of the omentum to the stomach near the greater curvature partly close off the lesser omental cavity to prevent hernia into this space.

The particular points I wish to comment on are first the great value of transfusion in preparing a weak, anemic patient for operation. They twice converted an extremely doubtful risk into one which could be carried safely through a considerable operation. The general rule of not operating on a gastric case during acute hemorrhage still holds good. When bleeding is not due to a chronic ulcer the bleeding point is difficult to find and control of the hemorrhage is uncertain. Under this condition operation is dangerous and of doubtful benefit. By transfusion we can support the patient, favor coagulation, and operate later should operation be necessary. In case hemorrhage is persistent, and seems to come from a vessel opened by a penetrating ulcer we can by transfusion improve the patient sufficiently to carry him through operation. It has increased our power of dealing with gastric hemorrhage so that in selected cases we can use operative measures instead of trusting to nature to check the hemorrhage and build up the patient sufficiently to undergo operation.

Transfusions are usually done on the surgical services of the hospital by means of Vincent paraffined glass tubes. This is preferred to the citrate method or syringe method. Professional donors, usually young students, are used when suitable donors are not obtainable through the family. A list of men, examined, grouped, and found negative for syphilis by the Wassermann test is kept up to date by the Medical Service. A direct test for agglutination between donor and recipient is done in these previously grouped cases when time permits.

The second point is turning the omentum up between the stomach and the pancreas (W. J. Mayo<sup>1</sup>). This changed an unreliable suture line into one which was relatively safe to leave and also covered and walled off the ulcer base. Drainage of a gastric suture line under these conditions I believe likely to favor leakage.

in front, instead of from the transverse colon, thus preventing any fixation of the anastomosis to the anterior abdominal wall. In the present case a somewhat similar anatomic situation was brought about by suturing a short thick omentum to the retro-peritoneal tissue in the region of the lesser curvature after turning it up between the posterior gastric wall and pancreas. It held the colon high like a second mesentery at the same time exposing the posterior gastric wall in front of the colon. Since repeated operations rendered an anterior gastro-enterostomy liable to crippling adhesions, union of the jejunum to this exposed posterior wall seemed a more promising procedure than the usual anterior operation.

The further history of the present case is as follows. There was little postoperative reaction. The stomach functioned well and he showed progressive improvement. His red count, twenty two days after his last operation, was 3,248,000. He was discharged four days later.

When seen, four months later he reported that his digestion had been good since leaving the hospital. He eats without distress or pain. There has been no vomiting. His only complaint is poor memory and occasional headaches. On examination his weight is 149 pounds, his hemoglobin 75 per cent. The abdomen is negative. There is no tenderness or hernia.

The case of pylorectomy and posterior antecolic gastro-enterostomy came for examination sixteen months after operation. His health and digestion have been excellent since leaving the hospital. He has been working steadily and has no symptoms whatever. Examination was negative. He appeared in very good physical condition.

Posterior antecolic gastro-enterostomy was done in these 2 cases because it seemed to promise the best function under the existing conditions. It is not ordinarily mentioned in text-books on operative surgery. I have since found the following references without attempting a review of the literature. Von Bergman<sup>2</sup> says this posterior antecolic gastro-enterostomy is theoretically possible but for obvious reasons not to be recommended.

In a recent case of pylorotomy for perforating ulcer I found a congenital absence of the transverse mesocolon, which prevented posterior gastro-enterostomy. But the shortness of the mesocolon and the fixed position of the colon allowed the stomach to overlap the colon exposing the posterior wall between the omentum and the colon itself. Here the posterior gastric wall

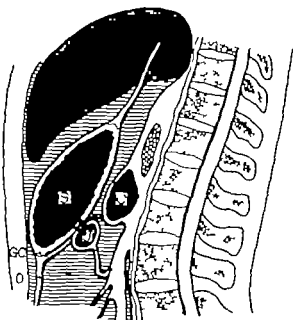


Fig. 407.—Diagram of second case showing congenital absence of transverse mesocolon. It is high fixation of the transverse colon making posterior retrocolic gastro-enterostomy impossible and posterior antecolic gastro-enterostomy feasible procedure. *St* stomach, *C* colon, *GC* greater curvature, *O* omentum, *J* jejunum.

was covered only by a thin vascular layer of gastrocolic omentum. The obvious thing to do was to bring the jejunum in front of the colon, and suture it to this exposed area of the posterior stomach wall. After suture the stomach and jejunum lay very well, and the anastomosis was protected by the omentum which hung down in this case from the greater curvature of the stomach.

of anterior gastro-enterostomy are occasionally unsatisfactory to record these 2 cases treated by an alternative procedure.

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- 2 Von Bergman System of Surgery N Y 1904, vol. p. 430.
- 3 Peis Laudes Chirurgische Operationslehre, Berlin, 1921 p. 561.
- 4 Doyon Operative Surgery (English edition) 1920, vol. iii, p. 278.
- 5 Ponsol Gas des Hop., 1896, pp. 891, 1248.
- 6 Hall Brit. Med. Jour 1903 2, p. 895.
- 7 Arnspenger Beiträge z. klin. Epit 1907-08, vol. lxi, p. 256.

Pels Leusden says that the method can rarely be used but only enthusiastic supporters of the attachment of the jejunum to the posterior wall of the stomach carry it out. Doyen recommends the method when a cancer invades at once the whole of the anterior surface of the stomach and duodenum and extends as far as the ligament of Treitz and the transverse mesocolon. He devised a method in 1892 which consists of division of the gastrocolic omentum introduction of the great omentum through this space and suture of the transverse colon to the posterior wall of the stomach. The jejunum is then anastomosed to the posterior wall in front of the colon close to the greater curvature. Pouch<sup>2</sup> used a similar method in 2 cases without definite anatomic abnormality. The function was good. Hall<sup>3</sup> used a gastro-enterostomy of this type as a normal procedure calling it the supracolic operation, and recommending it especially where the stomach is small and fixed. Of 12 cases, function was good in 11 in the remaining case constriction by band was relieved by operation. Armsperger<sup>4</sup> recommends the posterior antecolic operation in cases of carcinoma of the pylorus with adhesions or contraction of the transverse mesocolon, making the usual posterior operation impossible. He reports 3 cases, one by Cerny in which function was good.

Posterior antecolic gastro-enterostomy cannot be recommended on so slight grounds. I merely wish to point out that under certain anatomic conditions making posterior gastro-enterostomy impossible particularly a congenital absence of the transverse mesocolon with high fixation of the transverse colon it is not an illogic procedure. The usual argument against it is that constriction of the jejunum by the colon or vice versa is likely to occur. The higher the fixation of the colon and the greater the overlapping of the stomach anteriorly the less probable such constriction would seem. In my case the results have not been entirely bad even when this method has been used under normal anatomic conditions. Since the variations which make this operation possible are rare the experience of one operator is necessarily limited and further observations may be long in coming. Therefore it has seemed to me justifiable as the results

## POSTOPERATIVE HEMORRHAGE FOLLOWING GASTRO- ENTEROSTOMY TRANSFUSION GASTROTOMY

THIS patient, No 241,067 a machinist of twenty-four entered the Massachusetts General Hospital with the following history For twenty five months he has had recurrent attacks of epigastric pain without vomiting He is an ex-service man and for the past three months has been treated in a U S P H hospital for gastric ulcer His chief complaint was nausea and pain. The pain was worst when the stomach was empty and was relieved by soda or food. It often awakened him at 2 A M. On several occasions he has vomited blood the last time four days ago He was unable to work on account of his distress and pain.

Examination showed a well-built young man, apparently in good physical condition. Examination was essentially negative There was no abdominal tenderness or spasm He located the pain under the xiphoid cartilage The urine was negative The red blood-cells 5 760,000 and the leukocytes 5600 His hemoglobin was 90 per cent. A test meal showed no evidence of stasis, no blood by the gualac test and an acidity somewhat high but within normal limits.

x Ray showed no gastric residue There was a defect on the lesser curvature about 5 inches from the pylorus At this point there was localized tenderness. The duodenum appeared normal The findings were those of an old indurated penetrating ulcer of the lesser curvature

In view of the duration of his symptoms the absence of improvement under medical treatment and the fact that he was incapacitated for work, operative treatment seemed indicated This was further justified by the chronic and penetrating character of the lesion as shown by the x ray

Operation was done three days after admission under ether anesthesia. On exploration high on the lesser curvature of the





altered the whole situation. It was no longer necessary to take the chance of the bleeding stopping spontaneously. It was possible either to improve the patient's condition by transfusion and wait or to transfuse and operate, since it seemed clear that supported by transfusion the patient could be carried through a reasonable operative procedure. With the apparent profuseness of the bleeding and the possibility of a large vessel being exposed by cauterization of the ulcer it seemed to me on the whole wiser to take the risk of operation rather than of continued hemorrhage.

The patient was prepared for operation and transfusion. Ether was given by the drop method. The wound was reopened. There was no blood in the peritoneal cavity. The stomach after walling off was incised in its long axis through the anterior wall half way between its greater and lesser curvature. It contained a moderate amount of fresh blood which was evacuated. The sutured ulcer of the lesser curvature which I had supposed the probable source of bleeding was everted into the gastric opening. It was dry. The gastro-enterostomy stoma was similarly brought into view. This showed an ooze apparently coming from its anterior margin. The edge of the stoma was sutured over and over from within thus checking the ooze. The suture line of the cauterized ulcer although apparently dry was similarly treated. The opening in the stomach was closed with a continuous chromic catgut stitch through all coats with a second inverting layer. The wound was closed.

During the operative procedure he was transfused with 750 c.c. of blood. This was not done as a preliminary procedure as it was thought the hemorrhage might be sufficiently active so that some of it might be lost before the bleeding was checked. It was not postponed until after operation as it was felt he might need the support before operation was completed.

That the bleeding should have come from the stoma clearly showed a failure in technic. In one other case in which a posterior gastro-enterostomy was done for inoperable cancer of the pylorus bleeding occurred which undoubtedly contributed to a fatal outcome nine days after operation. The source of bleeding

stomach, a small induration was felt with a crater-like defect  $\frac{1}{2}$  inch in diameter in its center. The ulcer base was exposed by dissecting off the fatty tissue of the lesser omentum and ligating the branches of the gastric artery. The ulcer was destroyed by cauterization by Balfour method. The small opening was closed with two layers of chromic catgut, and the fatty tissue of the lesser omentum stitched over the suture line. A posterior gastroenterostomy was done with chromic catgut, the jejunum running from left to right. The appendix was removed as possible source of infection having a bearing on the occurrence of ulcer.

The patient was in very good condition following operation, which ended at noon. On coming out of ether he vomited three or four times the vomitus containing a moderate amount of blood, which was thought to be of slight importance. At 11 P. M. he vomited 4 ounces of bright blood. About midnight he vomited 2 pints of fluid apparently nearly pure blood. I saw him shortly after this. His condition appeared fair, his pulse had increased moderately. At 12.45 A. M. he vomited another pint of bright blood. Following this he became distinctly worse, his pulse rose to 145 and was of poor quality.

On first seeing this patient his condition seemed to me serious, but not desperate. He had lost a large amount of blood as shown by the vomitus, how much more had passed into the intestines was uncertain. It seemed clear to me that it was a case to be treated expectantly. When he again vomited a large amount of bright blood and his pulse rose to 145 it became evident that the hemorrhage was still going on, and that the situation was grave. His condition was then so bad as to make any operative attempt to stop the bleeding an extremely dangerous procedure.

If transfusion had not been available I should not have considered operation, believing the risks connected with it were distinctly greater than the danger of death from hemorrhage. With absolute quiet and large doses of morphin to stop peristalsis the chances were that bleeding would stop with the falling blood-pressure.

Fortunately a grouped donor was readily available. This

altered the whole situation. It was no longer necessary to take the chance of the bleeding stopping spontaneously. It was possible either to improve the patient's condition by transfusion and wait, or to transfuse and operate since it seemed clear that supported by transfusion the patient could be carried through a reasonable operative procedure. With the apparent profuseness of the bleeding and the possibility of a large vessel being exposed by cauterization of the ulcer it seemed to me on the whole wiser to take the risk of operation rather than of continued hemorrhage.

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was not determined it seems improbable, however that it should have been from the lesion. Two other gastro-enterostomies showed disturbing but not serious bleeding.

On reviewing the technic used in these cases the weak point seemed to me to be as follows. A seroserous suture was used to join the stomach and intestine. The stomach and intestine were then incised down to the submucosa, and these cut edges united by a suture which included also the submucosa and mucosa. The stomach and jejunum were then opened and a third layer placed along the cut edges of the mucosa (W. J. Mayo<sup>1</sup>). This part of the suture which formed the posterior part of the anastomosis as the stomach and bowel lay in the clamps seemed secure against bleeding. The anterior part of the opening was then closed by a continuous right-angled suture (Connell) through all layers. This suture although securing a beautiful inversion of the edges of the stomach and duodenum, I believe in my hands to have been the weak point in the occurrence of bleeding. Although it gives an excellent approximation for union once the edges are inverted, one can never be sure that hemostasis is absolute nor from the nature of the stitch is it certain that all bleeding points are constricted by it.

For these reasons I now use a continuous over and-over glover's suture for uniting anterior edges of the stomach and bowel to form the stoma. It appears to give greater constriction to the cut edges and greater security from bleeding. When the clamps are removed if bleeding should occur it is more likely to show. It does not give inversion, and on this account does not seem as secure against leakage. This I do not believe a matter of importance as the seroserous stitch which finishes the anastomosis in front gives all the protection which is necessary.

When bleeding occurs following gastro-enterostomy treatment is naturally by conservative measures. If however profuse bleeding continues, and the patient's condition becomes serious, we are in a difficult situation. If we interfere we may be doing just enough to kill the patient. If we wait, we are taking a chance as to the spontaneous stopping of the bleeding. Transfusion increases our control of the situation. It gives us longer

time to persist in palpation or enables us to carry through operative interference.

In the present case we were able to deal positively with a hemorrhage which without transfusion could have been treated only expectantly and to convert a dangerous situation into one which was relatively safe. Whether it was really necessary or wise to interfere in this case is uncertain. The general rule in such postoperative hemorrhages should undoubtedly be not to operate. Still occasional cases do die from hemorrhage. The method employed represents one way of dealing with the situation.

Having exposed the stomach, the direct and simple way to deal with the suture lines suspected of hemorrhage was to open the stomach, and suture them from within. Any other method of checking the bleeding would have been not only difficult, but uncertain.

The patient's pulse remained at 140 during the day following operation, his temperature 103° F. Both dropped steadily during the next day and he made a good convalescence.

Sixteen months after operation this patient reported himself well and free from digestive symptoms.

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## CLINIC OF DR. FREDERIC J. COTTON

BOSTON CITY HOSPITAL

### KNEE LESIONS AND OPERATIONS BASED ON 100 PERSONAL CASES

Nothing is commoner or more troublesome than the lame knees we meet. Mine are largely operative but not all by any means.

The cases on which this paper is based were seen at the Boston City Hospital and at Parker Hill a few while Parker Hill was in the Army Service more while it was P. H. S. Hospital No. 36. The rest are industrial or private cases.

The lesions are presented in crescendo order of seriousness not interest, and those primarily interested in open operative surgery may skip the first half of the paper.

The synopsis is as follows

- A. Synovitis, simple
- B. Synovitis with actual lesions demonstrable.
- C. Synovitis chronic
- D. Synovitis chronic luetac.
- E. Arthritis with effusion
- F. Arthritis, dry mild—fat ladies' knees.
- G. Adhesions within the joint.
- H. Adhesions, limiting outside the joint.
- I. Cartilage dislocations simple.
- J. Fringe pinching
- K. Cartilages with secondary joint changes.
- L. Villous arthritis.
- M. Osteochondritis dissecans.
- N. Free bodies—joint mice
- O. Contractures.
- P. Ruptured ligaments with and without dislocation.



- Q Patellar luxation chronic.
- R Patellar fracture
- S Ruptured quadriceps tendon.
- T Ruptured patellar ligament.
- U Avulsion, tibial, tubercle
- V Excision destructive arthritis, non-tubercular
- W Excision—tubercular arthritis.
- X Excision—joint trauma and deformity
- Y Plastic remodelling joint trauma—old.
- Z Arthroplasty
- AA Osteotomy for deformity
- BB Septic bursa.
- CC Septic joints.
- DD Charcot joints.

A. The simplest though not always the shortest in their course are the synovitis cases, 'water on the knee' resulting from almost any blow or twist, oftenest with a strain or partial tear of the internal lateral ligament.

Typical is the football knee proper usually the result of a twist fall from clipping with forced external rotation of the lower leg. This gives a strain or partial tear of the internal lateral ligament—immediate disability prompt synovial effusion.

*Tot 1* tears of the internal lateral ligament *alone* I have not seen.

The ordinary synovitis case treated by plaster-of-Paris or splints shows a very early *selective* degeneration and atrophy of the rectus portion of the quadriceps muscle. Such atrophy promptly leads to a lax joint and perpetuation of the synovitis (better and then anon recurring) for several months under the usual routine.

Under dequate but trained (and restrained) massage of joint and muscle the fluid goes, the muscle does not dwindle and one saves several weeks at least.

Nor have I done the operations associated, but have seen 2 of these done. I seek little more as to the external fascial clothing of the quadriceps internus.

Denied, as I have heard, by the neurologists, but familiar to everyone who is 'field worker' or clinician are the actual cases.

**A Synovitis, Simple.**—*Case 1*—S. H. aged fourteen, twist in running at baseball. Seen three weeks after immobilization and bandaging. Has fluid to one-third capacity of joint and marked quadriceps atrophy. Strapping bandage, daily massage, and directed exercises. No fixation. At school. Treatment begun May 22 1922. Examination, May 25th a trace of fluid quadriceps not yet normal but already a useful near normal, knee.

*Case 2*—D. aged fifteen. Knee twisted at basketball a week ago. A good deal of fluid. No great lameness. Some muscle atrophy. Treated as above, straps, bandage massage supervised exercise. Kept on at school. Seen January 18 1922. Discharged February 13 1922.

*Case 3*—W. of Bangor. Aged thirty. Hurt in auto accident. No gross lesion. x Ray negative. Effusion considerable. Beginning muscle atrophy. Seen at two days. Usual routine. Held in Boston for treatment, but not laid up. Seen February 6 1922. Discharged February 14 1922. Practically well.

*Case 4*—V. Aged thirty-five. Auto smash up. Seen next day. Had one previous synovitis same knee. Treated by me five years ago. Ex-athlete. Same routine. Seen April 20 1922. Discharged May 13 1922. Practically well.

*Case 5*—D. B. C. H. Male. Aged thirty-eight. Hotel employee. Fell in dark hall. Brought in by police January 15 1922. Knee already considerably swollen (also nose fracture). In bed. Swelling subsiding January 20 1922 massage etc. begun. January 22, 1922 walking. Wants to go home. Discharged. This is a hospital case, hospital treatment not bad as good as may be, perhaps not very good.

*Case 6*—D. Girl of eighteen. On February 5 1922 dairy fell. On regaining consciousness found she could not stand. Admitted B. C. H. February 13 1922. Swollen joint, nothing else. x Rays negative. Patella floating. Bed treatment, heat. February 17 1922 swelling much less. March 4 1922 swelling tenderness and pain about gone. Discharged. Rest treatment in hospital—not very good, but effective in a trivial case.

One has to add to this massage "active assisted" and

presently "resisted" motion, and the type of supportive strapping shown in Fig 408, and the further support of the Bender or a similar elastic (rubberless) bandage.

There is no reason why a synovitis case cannot go about without crutches (and the better for it) to a moderate degree and with reasonable caution. Reasonable caution includes a stout cane.

Synovitis cases should be—though often they are not—well after about six weeks.



Fig 408—Proper adhesive strapping for ambulatory treatment of synovitis of knee.

B Synovitis With Lesions Demonstrable.—Case 7—Male aged thirty-two H. Lawyer playing second base, slipped in throwing ball and gave knee both twist and impact. Unable to walk. Seen next day May 13 1922 Moderate effusion tenderness just inside patella over adductor tubercle at internal lateral ligament. x Ray shows crumpling in of bone over very small area at first two points. No lateral mobility

Bed, pillow splinting, strapping Massage next day At twelve days tenderness near gone, effusion now slight, no obvious quadriceps atrophy Up on crutches Still under treatment.

C. Synovitis, Chronic or Subchronic.—A type which calls for a bit more care. Neglected, there is a danger of working loose of the bone chips into the joint.

The common type is that of neglected case in which too long fixation lack of massage, and of muscle exercise have produced a loose joint.

Case 8—McG P. H. S. Young man aged twenty-three Injury to right knee in France intermittent attacks ever since. Some lameness, considerable effusion. For some months effusion

has not left the point entirely at any time. No locking.  $\alpha$  Rays negative. Physical examination negative except for fluid lax capsule, atrophic loose quadriceps. This is the familiar type in which lax joint favors constant recurrences of the synovitis without there being any actual lesion. Massage, active exercise of quadriceps. Thomas heel and strapping usually cure. Long-neglected cases like this are apt to take some months to get results under the best treatment.

Chronic simple synovitis is not always from neglect.

Mostly these cases yield to the treatment above outlined, but slowly.

Chronic synovitis not so yielding to treatment may be subjected to the treatment by a draining stoma, outlined in a communication published in 1915.<sup>1</sup>

The operation was the establishing of a stoma with reversed synovial edges draining into the intermuscular spaces of the thigh.

Case 9—J O'N. Aged thirty. Both knees operated and apparently cured. One of the cases of this series turned up years after with recurring effusion and also with pulmonary lesions. Obviously enough this had been a case of slow developing chronic synovitis of a tuberculous type.

D. Also there is a chronic synovitis the symmetric synovitis of Glutten, due to adolescent hereditary syphilis.

Case 10—L P. Aged twenty. City Hospital. Admitted February 16 1922. Family and personal history entirely negative as far as any possible causation of synovitis is concerned. Two months previous skipped a step and landed hard on heel of left foot. Left knee painful. Grew worse. Treated at West Roxbury Hospital for two months as neuritis, he says. Got worse. Admitted here. Complaint on entrance of dull constant pain worse by use particularly going up and down stairs. Knee stiff.

Physical examination. Nothing abnormal felt except marked effusion of left knee. Much fluid. No spasm. Limitation of motion by presence of fluid. Little if any capsule thickening.

Cotton Surg. G., and Obst. July 1915, p. 103.

Quadriceps atrophy only moderate. Not tender or hot. Not painful on moderate motion. Can walk, but not easily or without pain. x Rays show no bone changes recognizable.

**Clinical diagnosis** Chronic synovitis very likely hereditary, but, though of one side only. Treatment suspended till report from Wassermann. Wassermann of February 24, 1922 positive + + + +. March 4, 1922 on crutches seen in consultation by Dr. P. W. Thorndike to whose service he was discharged for salvarsan treatment. Examined May 29th in hospital, where

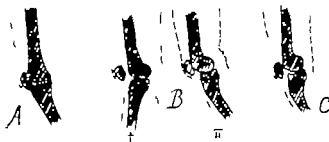


Fig. 409.—The last 20 degrees. A joint at 20 degrees of flexion fixed by bony ankylosis (A) is painless. A joint that can be fully extended passively but that is without power of active extension through the last 20 degrees (B) is unstable but not painful, and can be used for long standing. A joint that will not come within 20 degrees of the straight line, but that has motion is further flexion (however little) is almost useless for work as it is under constant strain on the joint, and the body weight is constant load on the quadriceps muscle.

he had been admitted for arsphenamin judgment which is rapidly clearing. Knee shows little fluid, very slight vague stiffness. Can walk without much trouble. Has been at work part of the time since his discharge. No other treatment than the arsphenamin. Improvement so striking as to amount to a demonstration and a diagnosis of this rare condition.

**E. Arthritis With Effusion.**—Some of the synovitis cases are actually arthritis more or less severe of acute infectious or mild recurrent chronic types, or the little understood "traumatic arthritis."

These cases yield to heat, to ~~very~~ careful massage and motion. In the graver cases one is wise to use supportive splintage for months.

Not is one supported by experience in expecting prompt restoration of function.

*Case 11*—A. Came to me May 6 1922 with what looked like a synovitis, with a history of slight injury ten days before but with little effusion some capsular thickening. The capsular thickening a limitation of motion not corresponding to distention or pain made it clear that there was more than a synovitis. Put on a routine of heat, strapping ~~very~~ cautious massage and motion, and regulated use he is now (May 25th) nearly well. June 9th motion nearly perfect, no symptoms. Still a smoothing of joint outlines that should be sharp from capsular thickening but no fluid or local heat.

*Case 12*—Father F. May 9 1922. Age forty two. Has had three operations on left knee, two for cartilages one for fringes and still has a troublesome, painful knee.

Examination showed nothing but a bit of creaking and some little quadriceps atrophy.  $\times$  Ray negative, save for some irregularity in form and texture of tibia at front edge of joint. No source of focal infection. Treatment by diathermy now (May 27th) has nearly cured the condition.

There seems to be a sort of habit-pain in knees much subjected to surgery even in the least neurotic and "the Padre is no neurotic. These cases belong to the intelligent physio-therapist ~~not~~ to the surgeon. In these proper hands they mostly do well.

*Case 13*—M. Age fifty-two. Construction foreman. Left knee twisted in a fall. When first examined showed a thick, tender knee without fluid. Extension 30 degrees short, motion into further flexion not over 20 degrees, held by spasm. Other knee comes nearly to straight line no symptoms but less grade of same process.  $\times$  Rays show hypertrophic changes.

Treated in caliper splint of convalescent type with steady strap traction to straighten. Gentle massage and motion and baking. Continued at work most of time. After about a year

Quadriceps atrophy only moderate. Not tender or hot. Not painful on moderate motion. Can walk, but not easily or without pain. x Rays show no bone changes recognizable.

Clinical diagnosis Chronic synovitis very likely hereditary but thought of one side only Treatment suspended till report from Wassermann. Wassermann of February 24 1922 positive + + + + March 4 1922 on crutches, seen in consultation by Dr P W Thorndike to whose service he was discharged for salvarsan treatment. Examined May 29th in hospital, where

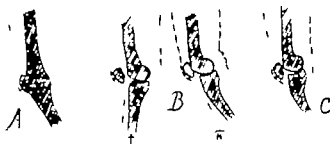


Fig. 409.—The last 20 degrees. A joint at 20 degrees of flexion fixed by body ankylosis (A) is paralytic. A joint that can be fully extended passively but that is without power of active extension through the last 20 degrees (B) is unstable, but not painful, and can be used for long standing. A joint that will not come within 20 degrees of the straight line, but that has motion in further flexion (however little) is almost useless for work as it is under constant strain on the joint, and the body is under constant load on the quadriceps muscle.

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E. Arthritis With Effusion.—Some of the synovitis cases are actually arthritis more or less severe of acute infectious or mild recurrent chronic types or the little understood "traumatic arthritis."

January 21 1922 Knee near straight. Temperature never ranging over 100° F Is now steadily normal.

January 25 1922 Gentle massage begun.

February 16 1922 Knee about straight.

February 26 1922 Up in convalescent splint.

March 4 1922 Discharged.

May 20 1922 Examined, joint near normal. Motion free for 30 degrees. To omit splint part of day Massage.

June 9 1922 More motion no pain x rays show cartilage thinning only Sent to P T May yet come to operation.

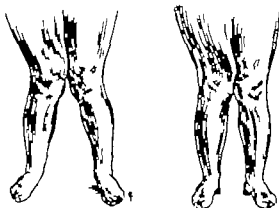


Fig 410 — 'Fat ladies' knees, as they come, and as they may be helped with Thomas heels.

F A class that is very common—a bit apart—is that sometimes called "fat ladies' knees," with symptoms, usually without effusion.

Knee strain, fat ladies knees due to weight, with or without knock-knee, usually with foot pronation, with or without arthritic changes.

Case 18—Sister R. Seen September 24 1921 Trouble with knees for months. Short and stout. Age thirty Shows slight hypertrophic changes. Moderate foot pronation. Thomas heels, strapping, gentle massage Improved but, even after months, improved and not well.



has a knee near straight, with freer motion and little pain. Can use it nearly as well as before.

*Case 14*—Mrs. T. F. Infectious arthritis with effusion immediately following influenza in 1919. Treated by rest, heat, and with vaccines (Dr. Geo. Sanborn). Later by cautious massage. Complete recovery within six weeks.

*Case 15*—Mrs. R. Another case following influenza—not so treated. Seen January 8, 1920. Painful knee flexed to 45 degrees, with firm adhesions. Adhesions broken up under ether. January 9, 1920 treated by traction, had a prompt recurrence of arthritis, and after months the result was and is a fibrous ankylosis somewhat sensitive, better than before, only in that it is at a 20 degree angle.

*Case 16*—H. B. Age forty-five. Tailor. Seen December 21, 1921. Some years ago a lameness of left knee for a short time. Present attack two weeks before seen. Knee exquisitely tender, swollen, hot, held in flexion, rigid spasm. *x* Ray confirmed apparently the diagnosis of an infectious arthritis of the destructive type. The sort of thing that so closely simulates tuberculosis in the adult. No source of focal infection. Traction in Thomas splint for eight weeks then and now a convalescent caliper splint have brought about subsidence of swelling, pain and spasm and the *x* ray shows a good return to normal density but there is going to be much loss of motion. May yet come to operation, like Cases 78 and 79 which it resembles.

*Case 17*—Subacute 'rheumatic' arthritis. Mrs. G. Age thirty-seven. Admitted January 1, 1922. Eight weeks previously sudden pain in right and left wrists. Next day right hip and leg, and four days later severe pain in left knee which continued.

Treated outside as synovitis. Sent to City Hospital only after many weeks.

On entrance left knee greatly swollen, tender, held in flexion about 80 degrees.

Balkan frame and Thomas splint with traction in series gradually changing line of traction.

internal incision vastus internus laid up and forward in a flap. Joint opened, patella (adherent by bone) chiseled clear surfaces smoothed both sides, muscle flap turned up and out and the edge stitched to the outer side of the capsule covering the raw patellar and femoral surfaces with interposed muscle. Superficial fascia lightly stitched

Usual after-care with early motion later usual P T things and a stretching under gas June 4 1921 Seen May 22 1922

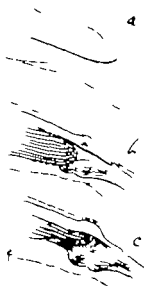


Fig. 411.—Diagram of operation on Case 21. The vastus internus dissected loose, rolled up under the patella, and sutured to the tissues just to the outer side of the patella, underneath.

has a free moving painless joint but with only about 40 degrees flexion. Full extension. Almost no limp.

H. Adhesions *without* the knee joint commoner and serious follow mostly fractures of the femur.

Brisement forcé long advocated has not made good.

Routine today in these cases is that of early motion—active assisted.

Early in the game the use of the Pearson-Thomas splint or the skeletal traction avoids the late treatment of many of these cases.

Case 19—Miss O'M. Seen February 17 1922. Lamé left knee without objective findings. Promated feet with "broken anterior arches.

Thomas heels, exercises. Morton cuffs with anterior arch pads.

Reported May 25 1922 Still a little trouble with feet, trouble with knee practically gone.

Past forty past 180 pounds, if one has the normal knock knee of the better sex, there is the liability to the promated foot, the ingrowing knee, with a subsequent creaking and "misery" in the joint that brings these cases to us.

Skiagraphs show nothing or little. On physical examination only a little dry creaking. Treatment is curiously efficient.

A "Thomas heel, a bit of adhesive strapping supporting bandage—these simple measures earn the gratitude and return of many of these heavy-weight cases.

When one can "put it over" a reduction of 20 pounds ensures the permanence of the cure.

Whether the matter in these cases is one of mechanics or of a middle-aged arthritis, is beside the point.

G Adhesions Within the Joint.—Case 20—C F B Old patellar fracture operated on by a colleague April, 1920. Seen November 16 1920 Aged forty-four Carpenter Only about 10 degrees motion, still infiltrated, sinuses newly healed very sensitive permanent flexion of 20 degrees. Caliper splint with straps to force into straight line. Very gentle massage and motion. Manipulation under ether April 25 1921 Last seen March 23 1922 with a normal looking knee 80 degrees of free flexion. Good function.

In Case 57 Dow operated on for foreign body there were long tough band adhesions and in Case 47 Styles, there were adhesions almost obliterating the quadriceps pouch. In both cases obviously factors in disability.

Case 21—Miss D. Aged nineteen. Seen April 12 1921 Five years before had subcut arthritis. Infection unknown. Knee fixed in 10 degree flexion with adhesions of patella only. Operation, Boston City Hospital April 15 1921 Arthroplasty

adhesions limit flexion to about 70 degrees from full extension, but also he has loss of voluntary extension—20 degrees short, and passive not within 10 degrees of normal.

In this particular case I could not advise Bennett's operation until I know more about it, and I am *not yet* ready to do it in Case 25 though he is "yelping" to have something more done.

*Case 24*—S S Fracture of right femur simple. Seen by me November 24 1921 eight weeks after fracture. About 1 inch short, good line, union pretty solid. Open operation not advised. Traction splint, walking, Thomas type.

In other hands to May 12 1922 Then stretched under ether with some gain. Now has about 25 degrees flexion no bony lock question simply of quadriceps adhesions. Should, under exercises prescribed, gain up to 60 to 80 degrees maybe to the desired 110 degrees within three to six months.

*Case 25*—J M F Age twenty two Gunshot wound left femur on French front in 1918. Septic, non-union, tenuous union finally by bone. Bone-graft at Parker Hill an attempt to *reinforce* union. Solid union, protected till safe by a splint then subjected to physiotherapy exercises including running and tennis to a forced stretching in the fall of 1921 under ether and to many stretchings by a husky trainer in the winter of 1921 to 1922.

At present has about 80 degrees of flexion, full function can do almost anything. A 6-foot, steel-nerved husky doing good work in our medical school, insistent on further surgery. So far his nerve is better than mine!

*Case 26*—V H. Aged fifteen. Thigh fracture August 2 1921. Seen in consultation, Malden Hospital, with Dr Staples November 9 1921. Non-union shortening of  $1\frac{1}{2}$  to 2 inches.

Operation November 12 1921. Sherman plate. Operation usually difficult, due to massive ineffective callus. Operation November 18 1921. Has had breaking down of blood-clot without active sepsis. Dakin treatment.

Operation November 24 1921. Removal of plate. Dakin treatment. Closed promptly.

Many come to us late.

"Bracement force" is usually contraindicated.

One must go gently

Come to a deadlock in progress toward mobilization, one may give gas and push on further *but only to give the masses a better chance!*

Later the patient, helpful, may do more than she can do by properly directed exercise.

Here and there one comes on a case calling for the operation of quadriceps lengthening—Bennett's operation.

This is easily done, and has only the disadvantage that one gains in flexion and pays in the slow though alleged certain, return of voluntary extension to 180 degrees.

I have done but one operation of the sort.

Case 22—P. M. Age twenty. Admitted to B. C. H. October 18, 1921. Previous entry November 26, 1920 to February 17, 1921 for gunshot wound fracture of left femur on another service. Had massage, etc. up to his entry on my service October 18, 1921 after I had seen him in consultation. Had little motion in flexion not over 10 degrees.

Operation October 20, 1921. Incision midline above knee. Vastus externus and internus dissected clear from the V-shaped cut in the rectus and the tendon. Knee flexed, muscle-bellies lightly sutured to tendon. Knee put up in semiflexion. Clean healing. Respectable course of physiotherapy.

Seen April 12, 1922. Flexion to about 50 degrees. Extension passive to 180 degrees. Active extension still about 20 degrees short of this. Fair power. No pain.

Seen June 5, 1922. Flexion to 110 degrees. Active extension still 15 degrees short of the straight line.

One is told, and I believe rightly, that the loss of full voluntary extension in all Bennett cases has been regained within year.

My one case is progressing at rate commensurate with this statement. Lately however I have seen a case in point.

Case 23—Seen at Parker Hill May 19, 1922. Old femur fracture lower and midthirds in military service muscular

ment of Hey are an old subject. Cases are common. The diagnosis depends on *history of slipping and a present locking* of the joint, or one goes on the history alone, as may be. Mere snapping is not enough.

Many knees snap even if nothing more is wrong than a slight laxness of the capsule. Not so many knees have loose cartilages. In the war among recruits, there were far more loose diagnoses than loose cartilages, and the mistakes and also the misadventures involved were common enough to justify very fully the order of Surgeon-general Gorgas restricting operations on these cases.

One must at times take on these cases for operation on history alone, though always with regret—but it must at worst be a *clean-cut history*.

If one *sees* a knee locked 20 degrees short of full extension with great pain evinced on attempts to extend farther if one finds a palpable cartilage outside the mean level of the joint, or no cartilage to feel but a definite tender point a bit in front of the midjoint line on the inside (more unusually on the outer side) there can be little question.

If one has a *perfectly clear* history of such a locking once or a dozen times, that may be enough.

Beware however of cases that talk about a locked joint immediately after the first hurt.

These cases do not run that way!

The first hurt may tear or break the cartilage and cause synovitis, but the locking usually occurs later and at a moment of relaxation with movement *not under strain*.

Semilunar cartilages, mostly internal semilunars without complication.

Case 30—M. A. Girl of eighteen. For one and a half years after a fall she has had trouble with the left knee off and on. It *locks* at times, swells, and becomes tender.

Admitted to B. C. H. August 7 1921. Left knee tender over inner aspect. No locking at present. Discharged to return if locking recurs. (Will return later!)

Case 31—R. C. Age twenty-four. In army service June,

Had flexion only to 25 to 30 degrees. Question of force or of operation.

Here again I am against both operation and brisement. Particularly at his age he should regain all function ordinarily gained by use. Surgery *cannot* yet promise him any more.

Case 27—C. M. Age twenty-four. Operated on for Dr. Caulfield at the Choate Hospital, Woburn, July 15, 1920. Motor-cycle accident two months before. Patella fracture sutured with good results, femur fracture not so good.

Treated by the intramedullary boiled beef-bone peg Ryerson type. (We all "fell" for this at that time.)

Had the delayed union usual with that technique.

Got union after use in a "walking Thomas" caliper.

At that time had about 40 degrees of motion.

Under exercises got rapid increase of function and flexion, went back to work as a motorman. Not seen since.

Case 28—Miss E. J. Age thirty. Auto accident. Seen May 11, 1920, after a week at the Peabody Hospital. Thomas splint advised, without results.

Transported to Boston, operated. Ryerson-Wilson Armour bone-peg, intramedullary splinting. Again, delayed union, long continued. Not yet, after two years, quite certainly bony. Has about 30 degrees motion. Walks pretty well without apparatus with cane.

Question further treatment still a bit open despite the advice of E. G. Brackett whom I called in as (late) consultant, but certainly not yet a case for muscle operation or forced flexion.

Case 29—Mrs. K. Age fifty-two. Extracapsular hip fracture, with some deformity. Seen two months. Melrose Hospital, with Drs. Townsend and J. C. Fair but not dependable union judged by x-rays. Thomas traction splint.

Seen April 14, 1922, shows solid union, stiffish knee. A case I think, for exercises. Not likely to get better than 40 to 70 degrees flexion perhaps, but can we offer better by any operation now at hand without risk of worse?

I. Cartilages.—Dislocating cartilages, the "internal derange-

ment of Hey are an old subject. Cases are common. The diagnosis depends on *history of slipping and a present locking* of the joint, or one goes on the history alone, as may be. Mere snapping is not enough.

Many knees snap even if nothing more is wrong than a slight laxness of the capsule. Not so many knees have loose cartilages. In the war among recruits, there were far more loose diagnoses than loose cartilages and the mistakes and also the misadventures involved were common enough to justify very fully the order of Surgeon-general Gorgas restricting operations on these cases.

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Semilunar cartilages, mostly internal semilunars without complication.

Case 30—M A. Girl of eighteen. For one and a half years after a fall she has had trouble with the left knee off and on. It locks at times swells and becomes tender.

Admitted to B C H. August 7 1921. Left knee tender over inner aspect. No locking at present. Discharged to return if locking recurs. (Will return later!)

Case 31—R C. Age twenty-four. In army service June



1918. Fell off a cliff. Knocked out, and on "coming to" could not walk, and continued unable to walk for three weeks. In 1919 knee "went out." Has been "out" three times since, and he himself unable to reduce it. On entrance to B. C. H. March 7, 1922 he showed slight tenderness over the outer side of the left knee. Motions not restricted. Refused the suggested operation. (Likely to return.)

Case 32—D. O'C. Boy operated on at B. C. H. May 26, 1922. History several lockings of knee. Entered May 24, 1922 with knee locked knee tender over inner side. Under ether the lock disappeared.

Operation May 26, 1922.

Usual internal incision. Internal semilunar cartilage torn across about at its front convexity with its *internal* portion displaced *outward* so as to wedge between joint surfaces—a very unusual lesion. Cartilage removed. Recovery so far uneventful. June 5, 1922 wound clean. No fluid, no temperature, motion to 15 degrees.

Case 33—S. Operated at Quincy Hospital February 4, 1922. Luxation of untorso right semilunar inward. Removed. Seen April 22, 1922, shows no reaction. Motion to 60 degrees needs only quadriceps exercises.

Case 34—J. Operated at Quincy Hospital April 17, 1922. Dislocation of internal semilunar right. Removed. No reaction. Too recent to call results—going on normally.

Case 35—J. C. October 1918 patient running, fell on left knee. Had to be assisted to his bed. Sick call next day. Laid up six weeks, not able to do a day's work since. Gives a history of "locking" at various intervals. Admitted U. S. P. H. S. Hospital, No. 36 August 17, 1920. Slight swelling of left knee with considerable thickening. Knee can be flexed completely but comes 10 degrees short in extension. Definite tender point over internal cartilage.

August 28, 1920. Ether operation (Cotton). Lateral incision. Internal cartilage found torn loose and dislocated backward. Removed as usual. Motion at ten days. Crutches, thirteen days. March 7, 1921 good function. Full range

of motion Good result, but leg not as reliable as it should be as yet.

Case 36—G History of locking without previous injury while at work, stooping somewhere in France. Referred by Dr C F Palmer of Naval Hospital. History after the first jamming of a repeated locking each time with a fleeting effusion.

Operation, 1920 Usual internal incision. Cartilage torn across near front end. Front one or two-thirds removed March 7 1921 Practically perfect result. Full motion. No disability though joint not quite normal with a bit of a lump in rainy weather and spasmodic pain at other times, but of short duration No locking

Case 37—B H. Age nineteen. Ship's cook. Getting out of bunk dislocated right knee. Knee locks on average once in two weeks several days before full motion returns. Very slight swelling on entrance (November 4 1921) 120 degrees of motion.

October 20 1921 operated on usual technic, lateral incision. Cartilage showed signs of tear with pinching with the loose end locking into the joint. Excision as to the anterior two-thirds. No reaction. Usual exercises. October 24 1921 30 degrees motion without pain. October 29 1921 stitches out 45 degrees motion. November 4 1921 110 degrees motion without pain. November 18 1921 discharged with good joint.

Case 38—J L. Age twenty five. A. E. F. Service injury kick-back of motor July 6 1918. Admitted to army hospital October 20 1921 September 10 1919 given vocational training, with history of knee locking five to six times daily Flexion to right angle only Operation October 21 1921 (Cotton) Removal of internal semilunar cartilage of right knee and of thickened fat pads. November 16 1921 reported doing well in all respects without history of locking

Case 39—G W Roy Parker Hill Age twenty-six. Hurt right knee in 1914 two months disabled. Thrown on board ship February 1919 Hurt other (left) knee says it locked and had to be manipulated back in place. Laid up afterward until discharge from service March 14, 1919 at Devens. Since then

no treatment. Knee weak, "gives out on him. On two occasions he has been thrown. Admitted May 31 1912 with left knee showing tenderness over internal cartilage, forward, with grating on motion, etc. No fluid.

Operation June 15 1921 Corner incision. Loose internal semilunar No tear Removed June 22, 1921 up in chair June 24 1921 easy exercises. June 26 1921 30 degrees motion, no pain. July 14 1921 home on daily pass. July 18 1921 90 degrees flexion. No locking since operation. Discharged to O P D No data since.

Case 40—K., Jos. L. Age twenty In training October 11 1918 fell, hurt right knee. Pain and swelling four days. After that frequent pain. Knee has often collapsed Feels something slip at times, and then cannot straighten leg Has been unable to work. Admitted to Parker Hill June 24 1921 Slight swelling right knee, a little fluid some capsule thickening, slight tenderness on inner side. No limitation of motion, no grating. A little increased lateral mobility

Operation July 1 1921 Lateral incision only Removal of loose internal semilunar cartilage with a conspicuously hypertrophied fringe of ragged cartilage reaching well over toward middle of joint.

July 5 1921 a bit of gut suture removed.

July 8 1921 motion started Sent to P T department

On September 3 1921 discharged, with note of the 5-inch curved incision, well healed and not tender 115 degrees motion without pain. "Improving favorably Temporary total disability until further examination. Recommended as fit for vocational training Not seen since

Case 41—G Age ———— Seen July 19 1921 Knee lame for many months following a wrench. Improvement under massage, then began to have locking in flexion.

Operated at Charlegate Hospital November 19 1921 Lateral incision. Inner semilunar cartilage removed. Convalescence unusually long but May 20 1922 has a practically normal knee save for limitation of flexion to 90 degrees, present before operation. A case with some arthritic element evidently

**Case 42**—Mr H. Age forty three. An old time athlete. Still and always active had had repeated injuries of late and particularly a heavy blow on the knee some eight months ago. The knee had been troublesome and had locked occasionally and finally locked at 20 degrees of flexion and staid locked. Also it was painful and there was a little effusion. The point of tenderness to pressure was over the internal semilunar cartilage.

**Operation.** Corner incision revealed thickish fluid generally dark congested synovial membranes bleeding freely and an internal meniscus, thick and "porky" torn near the front curve



**Fig. 412**—The Corner incision and exposure. The patella is cut half way through with saw then split. The incision goes to the top of the quadriceps pouch and down through the whole ligamentum patellae and also the ligamentum cruciatum, else one gets no room and no view.

the free edge turned back and inward, and the whole torn mass embedded in a big wad of granulation tissue and scar—a condition seen in no other case. Cartilage removed. Fat pads thinned, pannus edges trimmed. Joint closed as usual. Examined June 1921 the locking gone the joint convalescing in normal fashion in normal tempo.

**Case 43**—B. Public Health Service. Typical history. Injury in left knee in service. Recurrent lameness, and later recurring locking of knee. Operated on at Parker Hill Hospital February 7 1922. Removal of loose semilunar and part of fat

no treatment. Knee weak, gives out on him. On two occasions he has been thrown. Admitted May 31 1912 with left knee showing tenderness over internal cartilage, forward, with grating on motion etc. No fluid.

Operation June 15 1921 Corner incision. Loose internal semilunar. No tear. Removed. June 22 1921 up in chair. June 24 1921 easy exercises. June 26 1921 30 degrees motion, no pain. July 14 1921 home on daily pass. July 18 1921 90 degrees flexion. No locking since operation. Discharged to O. P. D. No data since.

*Case 40*—K., Jos. L. Age twenty. In training October 11 1918 fell, hurt right knee. Pain and swelling four days. After that frequent pain. Knee has often "collapsed." Feels something slip at times, and then cannot straighten leg. Has been unable to work. Admitted to Parker Hill June 24, 1921. Slight swelling right knee a little fluid some capsule thickening slight tenderness on inner side. No limitation of motion, no grating. A little increased lateral mobility.

Operation July 1 1921 Lateral incision only. Removal of loose internal semilunar cartilage, with a conspicuously hypertrophied fringe of ragged cartilage, reaching well over toward middle of joint.

July 5 1921 a bit of gut suture removed.

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On September 3 1921 discharged, with note of the 5-inch curved incision, well healed and not tender. 115 degrees motion without pain. "Improving favorably." Temporary total disability until further examination. Recommended as fit for vocational training. Not seen since.

*Case 41*—G. Age ———— Seen July 19 1921. Knee lame for many months following a wrench. Improvement under massage, then began to have locking in flexion.

Operated at Charlesgate Hospital November 19 1921. Lateral incision. Inner semilunar cartilage removed. Convalescence unusually long, but May 20 1922 has a practically normal knee save for limitation of flexion to 90 degrees present before operation. A case with some arthritic element evidently

Operation June 7 1921 Joint opened by long "Corner" incision. Internal semilunar loose but not torn, edge of ligamentum alaris on inner side definitely fibrous leaving no doubt of its having been pinched in the joint repeatedly Internal cartilage the fringe, and most of the fat pads removed. Usual treatment smooth recovery Examined September 7 1921 Knee negative save for scar and for sensitiveness to flexion beyond 90 degrees. Not yet quite normal as to weight bearing

Case 45—R Age twenty-nine. First seen in spring of 1919 with occasional recurring synovitis of left knee, each attack with pain, heat and fluid. No demonstrated locking, trouble had begun with slight trauma. Was considered a mild arthritis. Physiotherapy Tonals removed December 1919 He finally persuaded me to operate. February 13 1920 arthrotomy "Corner" incision Very definite scars from pinchings on the ligamentum alaris of the inner side. The pinched fringe removed, also the cartilage on that side for good measure though it was not obviously abnormal. There was the moderate synovial congestion of a slight arthritis.

Usual routine. Recovery slow even with baths, massage etc.

March 7 1921 still showed slight thickening of capsule and complained of occasional sensitiveness and heat, but joint fully useful and essentially normal. I have seen him lately and the recovery is practically complete

K. Cartilages Plus Divers Joint Changes.—Case 46—L. Age twenty-nine. Said to have been hurt in January 1919 Motor-cycle accident in France. History of fracture of knee obviously incorrect, as x-ray shows. In various hospitals of army service from then on discharged from service November 4 1919 with walking caliper which he has worn nearly all of the time since

On entrance could not bear weight on knee without caliper splint at all Full extension. Flexion to 15 degrees without pain. Limit of flexion 50 degrees. Tender everywhere about joint. Swelling minimal. Definite abnormal mobility laterally Thigh measure  $1\frac{1}{2}$  inches less than left. Operation September 20 1921 Corner incision. Crucials intact Signs of very mild

pads through lateral incision. Usual recovery with rather slow restoration of full function, due mainly to insufficient physiotherapy.

**J Fringe Pinching.**—At best there is a danger of confusion between cartilage displacement and locking from a pinched fringe.

At worst one does an operation under the wrong label.

Both conditions call for operation only if the cartilage is doubtful. do not forget to look at the fringe of the ligamentum alaria.

Sometimes these cases of apparent cartilage displacement show on operation evident signs that there has been pinching of the fringes of the ligamentum alaria with or without actual cartilage damage or dislocation. The only difference in symptoms is I think, the less firm locking and easier reduction in case it is a fringe that is caught.

You will recall that the ligamentum mucosum runs from below the patella down and forward to the tibial region and that it has the ligamentum alaria fringing out on either side. These (or the inner one so far as I actually know) may become caught between tibia and femur especially in joints with irritation, and consequently hypertrophy of all fringes.

I recall a couple of cases years ago in which this had happened so often that the fringe tip had been bitten into so often that there was a sclerosed corner of fibrous tissue with a definite groove between it and the body of the normal fat fringe.

The mistake between the pinched cartilage and the pinched fringe is not important, however save to pride in diagnosis!

**Case 44**—M Age twenty-six. While on a hike in January 1918 fell and struck left knee. Knee swelled and was lame for two weeks. In June, 1918 felt something snap. On several occasions since the knee has locked and had to be manipulated to get it straight. Knee has occasionally given way throwing him. Two weeks before entrance knee locked and has staid locked. Knee on entrance slightly swollen, tender on inner side. Held in slight flexion, cannot be extended or much further flexed.

fringes, some injection of synovia, generalized scattered adhesions (almost ruining the quadriceps pouch) pannous overgrowth here and there on to the cartilage, with definite osteophytes at the edges of the femoral condylar cartilages.

Pretty much everything taken out, including the osteophytes the cartilages the fringes, and some of the adhesions divided.

A "house-cleaning" operation on the joint!

Healed clean. Up in chair at twelve days. On crutches July 10th. Walking with cane twenty-seven days after operation. Examined at twenty-eight days. Flexion to 15 degrees. Extension to 180 degrees. Discharged to P T Department as an out-patient. Put through usual 'B and M' of the P T manual.

This man happens to have become a personal friend of mine seen rather often. He has done well, but naturally after six years of neglect, the knee has not been made by an operation of less than a year ago. But he has had no locking gets about with a cane less for use than for precaution and has become very active and, as it chances, a very useful citizen, his mid stance between two armies and two countries and a closely restrained sense of humor which must be Scotch, making him a very effective advocate of wise measures in the interest of the ex-service men.

Case 48—K. Dan. Age thirty-nine. Newspaperman. Admitted to City Hospital March 24 1922. For a year or so pain on and off in right knee. Attacks of anti-Volsteadism render the question of trauma uncertain. Getting worse, more painful less useful "snaps" at times, he says and takes several minutes to return to normal.

P E negative save for right knee. Very slight swelling. Extension to 180 degrees. Flexion to 45 degrees. x Ray negative.

Operation April 1 1922. Corner incision. Both cartilages loose (not torn) removed. Part of excessive fat pads under ligamentum patellae removed. Uneventful recovery.

April 29 1922. Flexion to 15 degrees without pain.

May 8 1922. Bearing a little weight.

May 12 1922. 45 degrees flexion and can bear weight. Discharged.



arthritis. Large fat pads and both semilunar cartilages removed, though cartilages show nothing definite. Normal recovery. Discharged November 10 1921 able to bear weight on leg, but without much free motion. Complaints of slipping of knee.

This man seen lately. Is working but still wears his brace most of the time. Objectively the knee shows nothing save stiffness. x Rays consistently negative. Lateral mobility gone, muscle atrophy better but one is at a loss to say why there should be persistent pain in this case. Possibly it may be related to the fact that the oculist cannot understand the loss of sight in one of this man's eyes following a blow over the eyebrow with no signs of actual eye or nerve damage. This in spite of the fact that the man, though highly nervous, seems not to be at all a faker and has persistently worked for a good many months past, surely not in comfort.

Case 47—S. A. Age forty-three. 1894-95 in India. 1906-09 West Indies. 1900-02 South Africa. Bullet wound right knee superficial, in 1902. Complete recovery. Fell on twisted knee December 17 1915. Same knee previously wounded but no connection apparently between old wound and fresh hurt.

This man one of the many Americans in Canadian service has put up with a lame knee which has locked frequently and thrown him several times until he got home declining operations properly enough offered.

History otherwise negative save for double lobar pneumonia and pleurisy in 1915. Admitted to Park & Hill Hospital June 15 1921. "Right knee shows marked limitation of flexion and loud crepitus and grating on motion of knee. On inner side of right knee is linear scar 3 inches long adherent to bone. On outer side is a small irregular contracted scar. No loss of function due to scars. June 21 1921 I saw him (had seen him before and had sent him in) and posted him for operation with a diagnosis of slipping internal meniscus, etc.

Wassermann negative. Union normal.

Operation June 24 1921. Corner incision. Joint showed loose internal and external cartilages much hypertrophy of

December 5 1921 Discharged to P T Department has 110 degrees of comfortable motion.

This man, repeatedly seen after above note has regained a knee perfectly serviceable for ordinary use but not quite normal in strength or reliability. He was not back on his rather arduous job in the merchant marine when last seen, but one can hardly rate him as disabled. There has been no locking since operation no attacks of synovitis.

**L. Villous Arthritis.**—In a lot of damaged knees traumatic or other one finds "villous changes, namely a general thickening of postpatellar pads everywhere sometimes extreme, and overgrowth of all the subsynovial fat tissues, often with many discrete villous masses.

I doubt if this is a class, save for convenience of description.

Some are hypertrophic arthritis, some synovial tuberculosis some essentially osteochondritis some seem to be merely old athletes' knees with innumerable traumata with not much care given them, as is the athlete's habit.

One is at a bit of a loss whether cases such as Cases 46, 47 or 49 belong to this class or another. Perhaps the following case really belongs here.

**Case 50**—A. G. Age thirty-two. Admitted to Parker Hill Hospital May 21 1920. Trouble with knee in army service about September 1918. No single trauma. Since then able to work for a while, but at intervals knee swells and becomes sore and useless. Nothing on examination save swelling with general and vague thickening. A type case, clinically of the "villous sort.

Operation May 22 1920. "Corner incision. Marked villous proliferation everywhere in joint. Cartilages loose, not torn. Both removed and with them a large amount of villous hypertrophic growth, including the great mass of the ligamentum alaria, both sides.

Spint to June 6 1920. After this date active use with massage. Discharged July 1 1920.

Re-examined March 7 1921. A knee substantially normal though the long outlines are not normally sharp. Says he has

May 25 1922 Turned up in my office. Flexion better than 45 degrees. No locking, no fluid needs exercise to develop the atrophied quadriceps muscle and use. Given directions as to exercise. To go on a farm and loaf and get back.

Case 49—M F B Lieutenant U S N Age thirty-eight. Injury to knee while landing a life-boat winter of 1919-20. Treatment delayed by shipwreck. Since then right knee has collapsed and thrown him from time to time, and also at times becomes locked locked firmly until manipulated.

Entered Parker Hill June 27 1921

Right knee shows slight lateral mobility grating on motion. Operation advised. Question of cartilage luxation, a bad knee, anyway and worth looking into Wassermann negative

Operation July 1 1921 Corner incision. Nothing definite except an internal semilunar cartilage, loss and displaced toward the middle of the joint. This removed.

Convalescence not without more than usual pain but no obvious complications. July 5 1921 dressed clean moderate effusion patient now comfortable

July 18 1921 Gentle exercises. Shows marked muscle atrophy to be combated by P T routine.

July 24, 1921 Up with cane

September 9 1921 Discharged with 90 degrees motion

Re-admitted October 19 1921 Has pain shows rounded mass in ligamentum patellae "slowly increasing in size. Now has only 75 degrees motion and a good bit of soreness. Seen by me before admission.

Operation October 21 1921 Excision of scar mass almost a fibroma, from the ligamentum patellae. Size roughly  $\frac{1}{2}$  x  $\frac{1}{2}$  x  $\frac{1}{2}$  inch

October 25 1921 Splint off

October 26 1921 Crutches.

November 1 1921 Walking with cane

November 7 1921 45 degrees of comfortable motion

I have not seen this occur before or since from the splitting of the patellar tendon.

Examined March 7 1921 Complaint None.

Excellent result. At work at former occupation at Charles-town Navy Yard. Full range of motion. In this case the x ray showed the joint mice and bone irregularities. There were patchy pocket erosions of cartilage at the condyle edges, particularly at the outer side but nothing in the notch. The rest of the lesions were irritative slight hypertrophic bone-cartilage edges, moderate thickening much congestion of synovia and of underlying fat pads.

He reports (May 26 1921) that he has a little "clicking once in a while" that he does not limp and has no pain that he can straighten it fully and can bend it "within a little" but it is sore for a day or two after straining it as far back as it will go. The shrinkage seems as though the fat all left at the operation and never came back. "It seems as strong as the other but I cannot run."

It may be worth mentioning that he is a powerful gigantic person, perhaps never a runner.

Case 52—J. D. History of years of trouble with the left knee with occasional locking and subsequent synovitis of a few days. Never any locking of considerable duration. Tenderness (and point of apparent obstruction) to the outer side. On examination showed nothing objective save slightest blurring of bone outlines and a little laxness of capsule and a little atrophy of quadriceps muscle. Slight abnormal mobility of tibia on femur forward. x Ray showed a small bone nodule in middle of joint. Operated on because of the intermittent crippling from displacement of the external cartilage, not for the laxity of the joint.

Operation March 7 1921 Cotton operating Cotting Dumphy assistants. Ether anesthesia.

Long sweeping incision carried  $1\frac{1}{2}$  inches to inside of middle of patella. Skin and superficial fascia dissected back. Knee flexed, knife cut to patella, midline. Saw cut in vertical line about  $\frac{1}{2}$  inch in. Patella then split with chisel placed in the long axis of the patella (not cutting toward the femur) and opened up. Cut from ends of this fracture line through the tendon up to

occasional discomfort in it, but nothing to interfere with the use of it to any extent.

Case 47 comes pretty close to this class there are no sharp dividing lines.

M Osteochondritis Dissecans.—A much discussed lesion!

The facts are that in a lot of cases there appear loose bodies in the joint, originating from deep within the condylar notch.

There are all sorts of theories why this should be.

The facts are that in certain patients not usually young often athletes or strenuous workers there appears, often after trauma, a certain sort of *dissecting process* in the cartilage of the femoral notch that in the end gives rise to free bodies in the joint.

There seems to be no "come back" in these cases when the "foreign bodies" are out and the notch cleaned though one might expect it. Personally I have no clear idea of the process involved.

The arthritic changes present seem no more than those that would be present in any joint so long irritated as in these cases when they come to us for operation.

Case 51—W. W. D. Diagnosis Loose bodies in left knee-joint.

On February 2, 1920 patient twisted his left knee while at work in navy yard. Injury did not seem severe, but began to trouble him after a few weeks and since then has intermittently laid him off work.

Admitted to this hospital March 5, 1920. Examination revealed movable body felt in left knee at inner aspect of patella. Painful to pressure motion not limited. Decision made to do radical operation because of osteochondritic changes obvious in the x-ray as well as the loose body.

March 10, 1920. Ether and "Corner" operation (Cotton). Median arthrotomy. Removal of three loose bodies with excision of redundant fat pad, osteochondritis dissecans changes, mild grade. Knee put in plaster. Cast removed March 24th active motion started. Uneventful recovery.

Discussed in detail in *Lesions of the Knee in Ex-Soldiers*, Cotton, The Military Surgeon, July, 1921.

definite pocket, attached at its base (not at the sides) and leaving on its removal a floor which was dark, vascular skinned over with light scar tissue. Some signs of joint reaction in dark color and thickening of synovial tissues and free oozing (Fig 413)

Treated as usual still in hospital (July 1921) doing excellently well. Not seen since.

Case 54—T O December 1920 at navy yard, patient twisted right knee while stepping from platform 2 feet high to a pile of angle iron. Knee pained severely but he worked till next day. Went to dispensary. Knee became swollen four or five times since. Then it developed habit of locking while

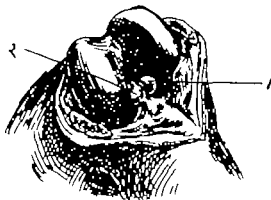


Fig. 413—Operative findings. Two loose bodies, one embedded in the ligament, one nearly free in its pocket, adherent by base only (Case 53)

walking with the accompaniment of severe pain and much swelling. Pain referred mainly to the popliteal space.

He was operated on May 9 1921 with the usual Corner incision under ether anesthesia.

The joint was moderately congested with a moderate thickening of fat pads in front. Directly under the split patella lay a 'marble' loose swiftly removed. Beneath this, lying well embedded in the front expansion and body of the anterior crucial lay a second bone cartilage body no part of it exposed in the joint. This came out.

Farther behind, within the substance of the external condyle

the top of the quadriceps pouch and down to the tibial tubercle, including the midline fat pad and the ligamentum mucosum. Joint then opened up and flexed. The bone node proved to be in the anterior crucial ligament, from which it was shelled out. One catgut stitch in the slightly lax ligament. This node entirely within the ligament apparently grew there. External semilunar cartilago loose and showing the thinned-out scars of many pinchings. The back half was displaced forward and lay in front of the femoral condyle, folded almost in contact with the front half. Whole cartilago removed.

The outer ligamentum alarium showed hypertrophy and distinct scarring and thickening from being pinched. This, the corresponding inner fringe, and much of the fat pad below the ligamentum patella removed, and the gap in the synovia brought together with catgut sutures in the fat not penetrating the joint. Joint washed out with salt solution. Knee then straightened and the joint closed—not too tight—with a few gut sutures in the tendon, not going through to the joint surface and close suturing with kangaroo tendon of the periosteal fascial layer across the gap in the patella. Loose skin sutures of silk worm-gut. Dressing—ham splint—no plaster.

(Later motion begun at two weeks splint off at three weeks. This case happened to show almost no effusion or other reaction.)

Seen May 29 1921 shows a practically normal knee muscles not yet back to normal.

#### Case 53—P. J.

First trouble with right knee in 1918 at Camp Dix, New Jersey pain and slight swelling. No story of injury. A few months later in France had similar trouble which lasted longer. On return to United States had pain and a locking sensation, and found a "marble" on the inner side of the knee which caused no trouble when "up" in the joint, but when lost in it gave pain and crepitus.

Operation May 6, 1921. "Corner" incision. Removal of loose bodies. Removal of internal semilunar cartilage. One loose body one lying in cavity in notch on interior side partly covered by crucial ligament expansion posteriorly lying in a

definite pocket, attached at its base (not at the sides) and leaving on its removal a floor which was dark, vascular skinned over with light scar tissue. Some signs of joint reaction in dark color and thickening of synovial tissues and free oozing (Fig 413)

Treated as usual still in hospital (July 1921) doing excellently well Not seen since

*Case 54*—T O December 1920 at navy yard, patient twisted right knee while stepping from platform 2 feet high to a pile of angle iron. Knee pained severely but he worked till next day. Went to dispensary. Knee became swollen four or five times since. Then it developed habit of locking while



Fig 413.—Operath. findings. Two loose bodies, one embedded in the synovium, one nearly free in its pocket, adherent by base only (*Case 53*)

walking with the accompaniment of severe pain and much swelling. Pain referred mainly to the popliteal space.

He was operated on May 9 1921 with the usual Corner incision under ether anesthesia.

The joint was moderately congested with a moderate thickening of fat pads in front. Directly under the split patella lay a "marble" loose, swiftly removed. Beneath this, lying well embedded in the front expansion and body of the anterior crucial lay a second bone cartilage body no part of it exposed in the joint. This came out.

Farther behind within the substance of the external condyle



the top of the quadriceps pouch and down to the tibial tubercle including the medline fat pad and the ligamentum mucosum. Joint then opened up and flexed. The bone node proved to be in the anterior crucial ligament, from which it was shelled out. One catgut stitch in the slightly lax ligament. This node entirely within the ligament apparently grew there. External semilunar cartilage loose and showing the thinned-out scars of many pinchings. The back half was displaced forward and lay in front of the femoral condyle, folded almost in contact with the front half. Whole cartilage removed.

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Operation May 6 1921. "Corner" incision. Removal of loose bodies. Removal of internal semilunar cartilage. One loose body one lying in cavity in notch on interior side partly covered by crucial ligament expansion posteriorly lying in

professional ruin prior to operation. To referee in hockey as it is played, one must have two knees.

I think he was the first patient operated on by the "Corner" incision hereabouts.

**N Mice or Foreign Bodies.**—Whatever their source these mice get in the way block motion, throw the mouse-owner and cause synovitis.

Personally I suspect they come from loosening and growth of chipped bone surface fragments within the joint, from broken osteophytes at the joint edges as well as from osteochondritis. Often one cannot say but one can help.



Fig. 415 — Foreign body loose in joint (Case 57)

**Case 56**—Back in 1915 'Roxbury Bill' McK. was a boxer of local note and of no mean ability. He retired for a time because a knee threw him for a decision, and threw him on his nose!

He came to me and I located (x ray) a free body at that time locked in the back of the joint. This was removed by a transpopliteal incision I have not since used.

In three weeks he was back at road work training and for a couple of years was to be reckoned with and retired at about the age of forty not owing to trouble with this knee but from the early senility that terminates all careers in professional athletics.

**Case 57**—H. F. D. Age forty. Superintendent of schools.

filling a large pocket with its large bulk, sat foreign body No. 3. It was clothed over with fibrocartilage and was marble round. The "socket" was likewise rounded and clothed, and on prying this mass loose from its (mainly basal) attachments there was almost no bleeding (Fig. 414)

A trimming of edges of the socket, which lay far back in the external condyle out of reach save in full flexion, a removal of a loose external semilunar to make sure and the usual removal of half the anterior fat pads before suture<sup>1</sup> concluded the operation.



Fig. 414.—Operative findings. Three loose bodies, one in the crucial ligament, one free and the three (No. 20 the plot) lying deep down and adherent by its base to the floor of the pocket (Case 54)

The patient is still in hospital but has already (May 27 1921) a neat looking almost normal knee. No later data.

Case 55—R. J. Age forty-one. Professional athlete and hockey coach. Was admitted to the B. C. H. in 1916. Operated a general 'house-cleaning,' cartilages, fat pads, and pannous edges.

The case is included only because he is still a notable referee in hockey in this state whereas he had been on the edge of

This is harmless, neat, and probably salutary as these pads are thick in all subacute cases, and I have latterly made this procedure my routine before closing the joint in nearly all cartilage cases and in similar operations.

frame with traction on splint to minimize the 45 degrees flexion at the knee.

May 29 1922 discharged temporarily with knee flexed to 30 degrees (less he says, than for a number of years) with a sinus with bare bone deep in behind the knee of unquestionably lessening area. Wound clean. Goes home for personal reasons. To return for treatment later

*Case 60*—Miss B. Age twenty. Acute articular rheumatism one and a half years. No discoverable cause. Many joints attacked, but the left knee attacked nearly a year ago and the right dating from October 1921. Present flexion of about 150 and 160 degrees respectively held largely by muscle spasm of the very low-hung adductors (biceps tendons not tight). Seen April 13 1922. Condition as sketched. No fever for some weeks. Very much depressed in general condition. Condition in every way has been improving rapidly under treatment with radium emanations under Dr. F. B. Granger's care.

Question of further treatment.

Very careful massage inducted, with results today rather satisfactory.

When one dares, this patient at some time, at the end of physiotherapy resources is going to have a tenotomy of the internal hamstrings of the knees, a correction of flexion, and some time after that gradual extension with a Thomas splint, Balkan frame (Blake modification) and of course the Pearson attachments to the Thomas.

The trouble in a case like this is the danger of awakening, in a still much depleted patient, the arthritis, which at best is always looming in the offing. How this may happen you may read in the sketch of Case 91.

Nevertheless one must go ahead with this girl, for straight, stiff ankylotic knees would be better than what she has.

Again, the earlier history of Case 91 serves to show what may happen if one rushes into a problem like this with too much zeal. It is a matter of judgment. As good Dr. W. B. Hill, Chemistry Professor in Cambridge used to say "This is a matter of guess-work gentlemen usually called judgment."

Knee troublesome for last two years without obvious cause. x Ray showed foreign body  $\frac{1}{4} \times \frac{3}{4}$  inch plus or minus at present at back of joint. Examined April 12, 1922.

Operation DeaBrislay Hospital, May 5 1922 Incision through quadriceps tendon. "Mouse" fished out of joint between femur and tibia. Various tight fibrous adhesions severed. Usual suture Painless convalescence. Discharged May 17 1922. Reported May 24 1922 with joint painless and without fluid. Presently to go "on his own."

Case 58—D June 5 1918 90 degrees motion, no fluid. Walking with a cane. Ex-service case sent to me by Dr. E. A. Codman, who had operated on him about ten years ago for a septic knee, with admirable result. He had, however had a locking of the knee lately repeatedly. On examination there was a curious "squaring" of the joint, without obvious disability and a smallish foreign body high up in the joint which had made trouble by locking several times.

I operated April 1922 and took out the "mouse." Owing to the queer findings in the x-ray I used the "Corner" incision, but found nothing important beyond the obvious mouse.

He had more than the usual reaction, and after five days had to have a superficial hematoma evacuated, but has done well since.

O Contractures.—Here and there one meets cases in which the trouble is sheer muscle contracture or scar contracture *outside* the joint. Two cases may suffice.

Case 59—L. Case of osteomyelitis of twenty years standing in a man of thirty-eight. Lower part of left femur affected, sinuses opening and closing for many years.

Admitted to hospital December 28 1921 with an acute febrile flare-up.

Operated January 6, 1922 opening up 1 divers sinuses making an open wound from the outer side into the upper popliteal space. Much pus. No sequestra. No obvious dead bone.

Tubes Carrel-Dakin treatment and (with return of temperature to near normal) traction strips, Thomas splint Balkan

*Case 62*—Case seen in army service at Walter Reed General Hospital June 1918—a fully luxated, loose knee with 30 to 40 degrees lateral motion and total disability. Operated as in Case 61 but with strips of fascia lata instead of silk for sutures. Protected with the usual caliper splint. Lost in the usual shuffle of army service, but when last seen (September 1918) had only a little lateral mobility with fair motion in the normal plane.

From this case I learned that no ligament operation gives final results from the jump. One provides a hitch going below the cortex of a reasonably resistant material (autogenous by choice) and protected motion in normal planes does the rest!

*Case 63*—M P Army officer's daughter Age——

Referred to me by Captain Furlong of the Portsmouth Station. A young girl of splendid physique. Knee loose uncertain, useless as result of accident six months previous. Abnormal lateral motion in knock knee direction, of over 20 degrees.



Fig 416—Diagram of operation. Artificial internal lateral from fascia lata run under the cortical layer above and below all outside the joint.

This case showed the external lateral and presumably the crucials torn, with a slipping of the joint of  $\frac{1}{4}$  to 1 inch of the femur forward on the tibia, to the outside. Operation March 9 1919. Long outside incision. Long strip cut from fascia lata and laced into place as shown in Fig 416.

Wore splints about six months.

April 12 1922 examined. Normal knee. No lateral play. No catching or slip. Flexion to 120 degrees. Is going to try tennis this season. Has tried most of the other things.

*Case 64*—D F S. A curious case in a number of ways. Aged twenty-one. Longshoreman. Playing football at Camp Devens 1918 thrown left knee severely wrenched. Admitted

**P Ruptured Ligaments.**—Rarely all the ligaments are ripped loose. If no arteries are torn, one reduces the knee luxation usually with ease. If one does no more, the limb is ruined for "nature" will not produce enough new fibrous tissue to carry the strain especially the lateral strain.

If one finds, early or late—case of the sort, the only recourse is an open operation. Various schemes have been devised, without great success, so far as one can learn.

The knee is subject to great strain and scars, or the footless little ligaments set in *through the joint* whether of wire or silk or fibrous tissue can hardly hold it.

Surgeons of experience know that ruptured crucial ligaments alone hardly entail a real disability.

The thing one needs is a competent posterior ligament and a decent internal lateral.

The Hey-Groves and other operations seem not to have made good if one can believe what one hears, and I think it fair to say that one cannot rebuild the posterior ligament, and that no operation aiming at actual restoration of the crucials has been successful save in a few cases in which freshly torn crucials have been sutured. I have my doubts even as to these and in the cases personally seen have felt that lateral ligaments artificial properly set at such a slant as to limit the prevailing luxation without interfering much with normal motion, offered the best bet.

Case 61—John F. M. Age fifty Ironworker Total luxation. Seen 1915 three months after injury. Lateral mobility in abduction about 30 degrees. A sturdy man, with a useless limb. Artificial ligaments of heavy braided silk set in under the cortical layer above and below inside and out, and drawn tight.

Aseptic recovery. Secondary arthritic reaction.

Silk removed after two months.

Arthritis, tenderness, limited motion, but lateral stability.

Gained motion slowly. Never went back to his trade but got along not badly and later regained motion to near 90 degrees. Died in 1920 of erysipelas, in the then prevalent streptococcus epidemic.



Fig 417—Case 65     $\Delta$  11/1/1921, before operation.     $\nabla$  1/5/22, partial recurrence.     $\circ$  1/16/22, again property held.     $\square$  3/22/22, present condition.

closed with chromic gut sutures. Strip of fascia lata removed 8 x 1 inch wide and halves of this wound through connecting pairs of drill holes in femur and in tibia on both outside and



to Parker Hill P. H. S. Hospital No. 36 June 19, 1920 complaining of weakness after short distance walking. Knee unstable. Some slipping, conspicuous crunching noise on flexion under weight. No noise on loose flexion. Anteroposterior mobility considerable, but only moderate laxness laterally. No fluid, no swelling. *Has had occasional synovitis.*

Various palliative treatments tried (by me) and at last sent to P. H. S. Hospital No. 36 for operation. June 20, 1920 operation (Cotton). Either incision over internal condyle, a long incision. Crucials found to be torn completely. Semilunars very mobile. Internal semilunar removed, crucials trimmed. 8-inch strip of fascia lata removed and laced in through drill and reamer holes to make an internal lateral ligament running *outside* the joint. Up on crutches August, 1921 with motion and P. T. Examined March 7, 1921. Tires on long exertion. Walks without limp. Very stable joint. Noise has disappeared. A bit of slipping three or four times. Ligament palpable. Lateral motion none. A. P. motion not much. Seen March 19, 1922. *Much the same. A stable joint, but not quite efficient.*

*Case 65*—B. S. Age twenty-three. Admitted to City Hospital September 8, 1921. Office worker. Previous history unimportant. Hurt in an elevator accident, car falling six stories. Various contusions. Left knee greatly swollen. Diagnosis of luxation of tibia outward. Delay to allow quieting down of reaction. Four days later reduced. On the thirteenth day put in plaster of Paris. October 26, 1921 again manipulated put in new cast.

December 12th I was asked to see the case. The reduction had not held.

December 12, 1921 transferred to the Fourth Surgical Service. Knee almost rigid save for lateral mobility. Displacement of tibia inward.

Operation December 16, 1921. Inverted V incision severing quadriceps tendon. Patella turned down. Lateral incisions extended upward. Contracted lateral ligaments cut. Semilunar cartilages removed. Knee flexed to clear then the outward luxation reduced (with a good deal of tearing). Joint capsule

outer side the most. Operation advised Examined April 10 1922.

Operation April 19 1922

Lateral incisions both sides artificial ligaments set in in the usual way without, in this case any opening of the joint. Artificial ligaments internal and external both rove in under the cortical layer and lashed and 'tautened' with catgut sutures as usual.

In this case involving a displacement (against the rule) of tibia *forward* the ligaments were laid in a bit obliquely *down and forward* particularly that on the *outer* side of the joint

Usual closure. Usual plaster Uneventful recovery Sent home in supporting caliper splint May 1922. Everything apparently solid

Seen June 23 1922 Joint solid 25 degrees motion. To continue splint for a month at least.

These cases are too few as yet to prove much but do cover certain points

- I One may get plenty of material (never missed) out of fascia lata. This makes good material mechanically and is tolerated
- II. By setting ligaments in and around beneath the cortical layer one gets a *fixed* hold the ligaments do not pull out or stretch away with use as do ligaments or tendons or *sutures set into* periosteum or into *contact* with bone or into any other of the fibrous structures.
- III They may be well lashed to start with and with time and use do gather to themselves other fibrous tissue of scar origin grow tighter and stronger (cf Cases 62 63 65)
- IV No such accession of strength can happen to any band even autogenous) that lies *within the joint* bathed in synovial fluid.
- V In a knee the *important* ligaments are the laterals (and the posterior which we can do nothing about as yet) If these are set skilfully so as to allow motion and so treated as to give them a chance to *gain* strength with use they are ample support for a useful joint.

inside of joint. The hitch secured with catgut sutures in plenty and the wound closed. Plaster with pressure to maintain replacement. Had pain, etc. but healed without reaction.

December 31 1921 Plates show some loss of position. Again ether re-reduction of joint. Reduction maintained this time by Thomas splint with pressure pads and longitudinal (Spanish windlass) traction. No further tendency to displacement.

January 24 1922 Massage begun

February 4 1922 Up on crutches.

March 10 1922 10 degrees motion Discharged.



Fig 418.—Case 66. B shows in contrast A the dislocation backward of the outer condyle. C shows abnormal width of the outer joint space. All these taken before the operation.

June 1 1922 Can walk but with a limp. Motion not over 20 degrees is coming back too slowly some spasm. Measured for temporary supporting caliper splint. Not yet satisfactory but recent plates show reduction perfectly maintained and *there is not a trace of lateral mobility* even under forced manipulation.

Case 66—V. L. Boy of sixteen. Hurt a year ago in fall. Since then half-crippled with knee that snapped out on slight provocation. Figure 418 shows fairly well the backward slip of the external condyle on the tibia. In fact both slipped the

patella down to near top of tibia. On inside a similar cut not quite so long. Patellar tendon split in half, as in Goldthwait's operation, and the distal end cut clear passed under the intact half and sutured into the lower end of the inner cut in the capsule. The rest of this cut then overlapped  $\frac{1}{4}$  inch and quilted.

Clean healing

April 18 1922 Crutches.

April 22 1922 Walking. Flexion returning at fair speed.

April 28 1922 Discharged with 30 degrees motion. Walking fairly well. No tendency to return of luxation

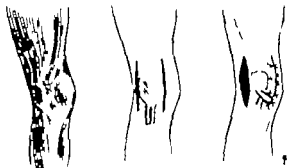


Fig. 420.—Operation done in Case 67

A new operation in its details I think. Of interest is the possibility of doing all this without opening the inner synovial capsule at all.

R. Patellar Fracture—Case 68.—Mrs. H. Aged forty. Fracture by indirect violence. Crashed a Buick into a post with foot on the brake. Transverse fracture, wide separation.

Seen August 17 1921 at Baptist Hospital. Operation August 20 1921. My usual incision, inverted U about the patella (to avoid the thick skin below hard to sterilize). Clearing of joint surfaces of clot and adherent inverted torn periosteum, washing out with salt solution, suture through solid tendon at sides of patella (Blake technic) and also of lateral tears and of the torn tissues in front of the patella. Two su-

**Q Chronic Patellar Luxation.**—A luxation outward of the patella, permanent or recurring with each flexion, asserted to be due to malformation of the femoral condyles or to knock-knee. These conditions certainly would favor it, though I have seen no case as yet showing defective development of the external condyle.

**Case 67** —G. K. Age ten. Admitted to Boston City Hospital March 1 1922. Nothing in history of any interest save the allegation that she struck knee on a rock at an indelibly

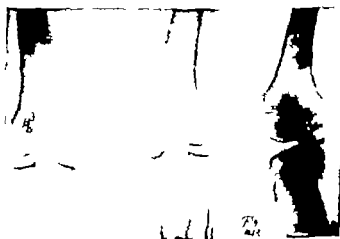


Fig. 419.—Case 67. Chronic luxation of patella, the two knees contrasted. The lateral view to the right, does not show any definite abnormality in the shape of the condyles.

early age. Patient's aunt noticed something wrong about a year ago. Limp began two or three months ago.

Limb normal, save that right patella lies over external condyle in extension, and on even slight flexion slips down and back to the outside. Quadriceps less developed than on left. Walks well enough with only a little limp. No obvious uncertainty in gait.

**Operation.** Long lateral incisions in and outside patella. On outer side the ligamentous capsule split from  $1\frac{1}{2}$  inches above

Operation February 24 1922 Usual technic exactly as in Cases 68 and 69 Drainage to one angle of wound.

February 26 1922 Drain out.

Temperature never over 99.6° F

March 10 1922 Stitches out

March 26 1922 Massage and motion.

Flexion returned rapidly Discharged April 1 1922

Case 71—A. Age sixty five. Spare wiry Fracture right patella by indirect violence May 26 1922. Wide separation of fragments.

Operation May 1922

Usual incision.

Three fragments.

Usual technic with care as to approximation of the third (outer) fragment. Usual symptomless convalescence.

Motion and massage begun June 8th, a bit *earlier* because of his later years

June 12th Motion of 25 degrees active. Still in bed

June 22d Motion improving Sent home for further treatment. Crutches

Case 72—Mrs D Age forty Fracture of patella with separation, years ago fracture of other knee pan. operated on good results.

Operation March 15 1922 by Dr Lahey Technic as in above cases. Usual routine. Motion at three weeks 40 degrees flexion at five weeks. Allowed up cautioned not to bear weight bore weight on foot refractured patella April 18 1922

Second operation (April 21 1922) Cotton Wound reopened Clot cleared fibrous thosae resutured in front. Joint proper *not* opened

May 13 1922 Cautious motion begun.

June 20 1922 Flexion of 45 degrees.

In a case ten years ago I got a like result by *strapping* in a case of this sort. Remember that the torn periosteum does not fall in a *second* time and it is this periosteum that interferes with union

Why *cert in people* are liable to fracture on the other side

tures *in front* of the torn bursa to avoid skin adhesions. Loose skin suturing. Ham-splint, foot laid in "pillow splint" (no plaster of Paris in this or any case of recent years. I see no point in making a poultice hemostat for bacterial growth unless one must). Recovery uneventful save for temperature for a week from an incidental pyelitis.

Motion begun at three weeks 45 degrees of flexion at six weeks.

Up on crutches.

Discharged September 20th, 1921

Function perfectly good at eleven weeks (November 4 1921)

*Case 69*—Miss R. W. Admitted to City Hospital March 9 1922. Age twenty-five. Four years ago fractured right patella. Operated on in Toledo Ohio. Now shows fracture of left patella received in auto accident today. Marked separation of fragments, with much effusion. Young round, fat young woman.

Operation March 10 1922. Usual inverted V incision. Technic as usual (and as in Case 68) throughout, save that on account of overwhelming fat the wound was drained at the corner (with "rubber-dam") for three days to take care of clot and fat ooze.

Healing without reaction but temperature normal only after eight days. Stitches out at thirteen days.

April 4, 1922 (twenty-four days) Motion begun.

April 16 1922 20 degrees flexion.

April 20 1922 35 degrees flexion.

April 29 1922 45 degrees flexion. Allowed to bear a little weight on leg.

May 2 1922 Discharged walking with and part of the time without, crutches.

June 20 Report by letter. Good progress.

*Case 70*—E. C. Admitted to City Hospital February 22, 1922. Age fifty-two. Fell on ice today. Carried home. Previous history unimportant. Sturdy woman in good health. Right knee swollen a fingerbreadth gap between halves of patella. Aseptic preparation.

handled, one after a fracture without separation by direct violence, which never was treated as a fracture at all.

A word of epilogue as to the patellas.

To day all cases are to be operated on if operable, that is if proper surgical risks and if they can command proper surroundings and clean skill. The results of conservative treatment are not very good (though everyone has seen useful knees so treated in the earlier periods of surgery) but more particularly they are too slow. The non-operated case takes a year with operation, three to six months to full function, sometimes (Case 73) even less.

But there is no excuse for operating on cases without separation of fragments, cases almost trivial by comparison, and sure of as good a result without operation as one can give them by open methods.

Technic has become almost fixed. The incision is of no great moment—not a longitudinal cut, for that gives no access to the tears in the lateral capsule on both sides—not a cross-cut at the fracture level, because that, like the longitudinal, gives a certainty of a ripped open joint in case of refracture—not so very rare.

Cut a U or an inverted U well clear of the fracture line. Either gives an area of anesthesia below the cut for months with the inverted U this area is over the kneeling surface more present to the patient's consciousness. I use this cut, however for safety in asepsis as above stated.

As to time of operation, the rule used to be 'immediately or not till after ten days.' Today it would read 'immediately in compound cases or in cases nearly compound (cf. Case 73) in other cases as soon as one can get adequate skin preparation, but not at a period of sharp hemorrhagic reaction or of synovitis.

One hates to say so without "rapping wood" but one has not had a case of infection yet operating at all sorts of dates. Luckily as I have long maintained, the joints are rather tolerant of minimum bacterial dosages!

Save slight subcutaneous infection in Case 76



and to refracture of the once broken patella I cannot quite understand. Yet this liability does exist. Rarely they are ataxica. Never are they athletes or gymnasts. Probably it is a matter of lack of elasticity and of fine co-ordination.

*Case 73*—Dr J. P. L. Seen September 14 1919. Fracture of patella, almost compound, received in argument between a Marmon car and a freight train passing at right angles. Other injuries to side, etc. not major.

Operated next morning at Lynn General Hospital, usual technic. Recovery as usual. Only notable in that he was driving a car at six weeks and is still driving without limp or disability.

x Ray January 5 1920 showed 'some osseous union.

*Case 74*—Dr B. Age thirty three. Fracture of patella, indirect violence, running to a fire. Operation at Dr Bedard's Hospital in Lynn. Usual technic, usual recovery.

Notable only in that an x ray taken rather in just a year later when he had been running to fires for months, showed only fibrous union with sharp tilting of fragments. H. is still as good as new.

*Case 75*—B. Age twenty-eight. Operated on six years ago for usual patellar fracture. Usual convalescence. Seen November 1921 for a subpectoral abscess. Knee absolutely normal. Only scar to be found.

*Case 76*—Mrs. J. A. H., Maynard, Mass. Age thirty-eight. Large, heavy (near 200 pounds) robust. Transverse fracture of patella eight days old. Operated, usual technic, November 23 1916. Convalescence slow. Motion regained slowly never far beyond right angle. Trouble with prepatella bursa tapped once. Trouble with subligamentous fat pads, relieved in the end by proper special shoeing and physiotherapy.

Personally unlucky! Not all patellar fractures prove trivial, especially in the big folks, even with the best technic and care.

I have seen, though not lately seriously limiting adhesions following mild sepsis, with an eighteen-month convalescence, and later refracture from slight accident and have seen 2 cases of serious limiting adhesions, one after a clean operation properly

Had developed perhaps from some pressure of splint or compression of dressings, a complete toe-drop without sensory loss.

April 25th up and about with canes toe-drop showing signs of recovery under stirrup support, massage exercises.

May 9th Motion to 60 degrees. Still a trace of toe-drop remaining but otherwise normal.

Case 78—P G Age eighteen. Admitted September 30 1921 History of sprain and contusion of knee at football twenty four hours ago Knee lame and sore, tender over tibial tuberosity definitely localized

Strapped and put up in pillow splint. Started a temperature next day and ran from 99° to 102° F for a week.

Operated October 7 1921 Abscess opened. Culture showed *Streptococcus hemolyticus* and *Staphylococcus pyogenes aureus* as well.

Operated October 17 1921 Radical operation removal of sequestrum 1 x 1 x  $\frac{1}{2}$  inch from external portion of tibial head pus plenty Dakin tubes.

Discharged December 23 1921 healed.

Readmitted January 23 1922 with swelling over wing of ilium. January 25 1922 operation curetage, very free hemorrhage. Pathologic report of cureting showed endothelial growth! From this time on failed and presently died (February 20 1922) partly as result of repeated secondary hemorrhages from the wound. There was never any pus from this wound but the autopsy showed extensive destruction of the ilium and sacrum.

No one seems to have any clear idea of the interrelation between the trauma, the obvious hematogenous infection and the later neoplastic pathology.

Case 79—J M Age thirteen. Seen in 1915 Developed first a separation of the right tibial tubercle from a doubtful trauma This was strapped and consolidated as usual. Three months later developed an effusion bursitis of the membranosus tendon sheath on the other (left) side which was cut out and two months later a definite but not severe bursal soreness and thickening of Achilles tendon on the right side This subsided

As to technic the wiring method is as dead as Malgaigne's hooks, and silk has no place.

Blake's method is the only one.

A close-pulled mattress-suture of kangaroo or chromic, taking in the edges of ligamentum patella and of quadriceps tendon on either side a suturing of the torn fibrous capsule on either side a suturing of the fibrous periosteal layer and the bursal tissues in front to avoid skin adhesions—these are the essentials.

Always clear out in turned periosteum. Always curet the broken surfaces clean of blood-clot. Personally I always pack the joint across before I do this cleaning and then wash out with salt solution—and *do no handling or sponging within the joint*.

A *ham splint* is preferable to plaster—not *puncturing* the wound.

Motion and massage at three weeks to the end of gaining 45 degrees of motion. *at six weeks*—then up on crutches—weight bearing with crutches at seven weeks—a cane at eight weeks, full function for a trage use at three months these make up my routine not often varied.

In older patients earlier motion in older clumsier heavier patients later weight bearing.

S Quadriceps tendon rupture mechanically the equivalent of patellar fracture but occurring in my experience almost always in elderly patients, mostly men.

Case 77—A. Seen with Dr. Colmes March 2, 1922. Man aged sixty-five. Spare sound vigorous. Stumbled on stairs March 1, 1922. Shows obvious gap just above the right patella separation  $\frac{1}{2}$  to  $\frac{3}{4}$  inch. Almost total loss of extensor power.

Operation March 7, 1922. Des Brisav Hospital. Usual incision as for patellar fracture but rather higher. Tendon found torn clean across but with only slight tearing at the sides. Tear to the heavy subsynovial pads only joint not open. Mattress sutures of kangaroo after refreshing surfaces. Dressmaking sutures of the successive layers. Splint. Sent home at six days. Massage begun at three weeks. Up at six weeks.

in some defect of epiphyseal consolidation, as Case 79 suggests but hardly a disease.

V Arthritis—Infections—Destructive Excisions.—Case 80 — Dr T F H. of Lynn. Age thirty-six. Chronic knee joint history of recurring synovitis attacks following a couple or more of twists and blows in cranking auto in a knee previously not quite normal. Trouble one and a half to three years. No teeth tonsil or other focus discoverable. x Ray practically negative.

Operation July 21 1919 Corner Incision Joint full of villous growth, purple, congested but without degeneration. Cartilages roughened, with 'pannus' invading its edges. No free fluid. Joint cleaned out thoroughly with removal of great masses of fat behind the patellar tendon. Semilunars not removed. Usual closure.

Pathologic report 'Hypertrophy of synovial villi. No tuberculosis.'

He did well for a while, did too much, got a fresh twist, got gradually worse again.

February 11 1921 Put up in plaster to allow for gradual straightening etc. Got nowhere with this.

x Rays shows marked capsular thickening thinning of cartilages, bone proliferation at joint edges

No progress at all operation desired.

Operation March 16 1921 Charlesgate Hospital Excision with fixation at 30 degrees very thorough, clearing out of capsule and of joint remainders. Dr Leary reported again villous arthritis no tuberculosis.

June 29 1921 I had to remove a wire and screws on one side. Since then a stiff knee at 25 degrees, perfect use, no pain, heavy surgical specialist's practice

Case 81 — Miss A. C. Girl of nineteen years. History of infectious arthritis over a year Referred by Dr H. (Case 78) Entirely crippled. No source of infection discoverable.

Operation (September 1 1921) as in last previous case, plastic excision.

Pathologist, Dr T Leary reports bone with lymphoid

under treatment and has not recurred. No toxic cause could be discovered to account for any of these disturbances.

**T Ruptured Patellar Ligament.**—No case in this list. Again the mechanical equivalent of patellar fracture from like accidents. Rare. Not always a complete tear not always opening the knee-joint. Always calls for suture. Convalescence a bit longer than with the fracture results the same as to function.



Fig. 421.—Case 80 after healing. Note the “rabbling” of surfaces to give stability and broad repair surface. In this case screws and wire were used unnecessarily no doubt.

**U Avulsion of the Tibial Tubercle.**—A tearing away of the insertion of the quadriceps. It occurs in boys of ten to eighteen, and usually the part torn away is the tip of the long epiphyseal tongue that runs down to make part of the tibial tubercle. In other boys this portion seems an originally separate epiphysis. Commonly the separation is not complete.

For some reason this condition, obviously traumatic in all the cases I have seen, is listed as a disease—Osgood Schlatter complex. Perhaps there is a cause contributory to the trauma

Last operation (June 2 1922) Enuclention of local abscess in said elbow prospects favorable.

The T B knee has shown a perfectly serviceable symptom less joint for these six years and the present condition—solid though with fibrous rather than bony union—is shown in Fig 422



Fig 422—Case 82 Final result three years later

Case 83—D G P of Buttonwoods, R. I. Seen October 14 1919 Age fifty-eight. Laborer Five years of joint trouble culminating in serious lameness. Crutches since spring of the year Much loss of weight, pain disability Joint thickened motion gone, spasm Obviously I thought, an early senile T B joint

Operation (Charlesgate Hospital October 27 1919) almost exactly as in Case 68 save that there were small patches of caseation. Type excision Type T B knee of origin appar

Infiltrations, frayed cartilages villous masses, fatty almost myxomatous in places, enclosing here and there islands of fat. "Near surface this tissue is vascular and shows evidence of old hemorrhage in the form of abundant brown granules (blood pigment). Small recent hemorrhages occur in deeper portions. Tissue is heavily infiltrated with lymphoid cells, especially near surface." "No evidence of tuberculosis could be found. Diagnosis "Chronic villous arthritis."

This young woman did perfectly well after operation. Left the hospital September 16th—fifteen days. Last seen (April 5, 1922) a fair knee in good position, cleanly healed, solid, leg not yet in full function, but painless and evidently in line to duplicate the last previous case.

W Arthritis, Tubercular Excision.—Case 8.—P C., of Revere. August 30 1916. Trouble with left knee for a year lately much worse. Joint swollen. Can walk but with stick. Not trace of muscle spasm. Limitation to 30 degrees flexion by the free masses in joint and the periarticular thickening. Some abnormal lateral mobility. Wasserman by Boardman negative September 22 1916. Looks like a villous joint of synovial T B origin, but the x-ray shows a good deal of bone damage.

Operation October 7 1916. Charlestown Hospital. Knee-joint near gone. Tuberculous of the "languid" type repair going nearly stride and stride with the destruction. A very careful and radical excision done. Usual closure and splinting.

October 18th Clean.

October 20th Plaster.

November 3d Plaster cut.

Pathologist, D F B Mallory reports (October 11 1916) "tuberculosis."

He did particularly well and went back to active business.

On December 26 1919 he came to me about his left elbow which shortly after the knee healed began to give trouble and x-rays by Dr Paul Butler showed similar languid T B of this joint which I excised May 17 1921. Postly T B T (Leary)

spaces, etc. reported) and died thereof late in 1921 or early in 1922.

*Case 85*—S Tuberculosis of left knee. Examination January 5 1922. Man of fifty-six. History of lung T B nine years ago arrested, but some bronchial trouble some emphysema some asthmatic attacks, apparently not cardiac, though his heart was poor in strength. Knee joint of nearly a year's duration with little treatment, pretty obviously T B



Fig 423—*Case 85* Synovial tuberculosis in adult. Note how little osteoporosis, how little bone decay appears, very different picture from what one sees in children. Primary synovial in this case yet there was widespread tubercular infiltration of bone. Sometimes the repair process goes on with the invasion, giving very confusing picture.

x Rays (Dr P F Butler) showed (January 10 1922) extensive destruction of the cartilaginous surfaces of both tibia and femur with consequent narrowing of the joint space—most likely tuberculous.

Amputation had been proposed by Dr C F Painter who held that he would not stand an excision might stand amputation. Perhaps he was right. An amputation declined. I did excision January 13 1922—a doweled excision without plates or wires or other than absorbable sutures.



ently synovial. A bit of leakage from wounds. Kept in cast at 30 degrees flexion. Sent home December 6 1919.

Not seen since, despite letters, and while the letters of account have always been cheerful, I suspect the economic result, at least, leaves something to account for especially as this man is not in the early lusty years.

Case 84—J. G. of Northampton. Sent by Dr. J. H. H. Kelly. Seen December 27 1918 and January 17 1919. Book layer. Age twenty-six. June 18 1918 struck left knee with a twist added. Became lame, but the joint never locked. Picture of a villous arthritis. No improvement under routine treatment.

Operation, Charlesgate Hospital, July 23 1919. Joint opened. Almost exactly like that of Case 72 save for suspicious caseous areas at the base of some villi behind the patella.

Did well enough, not too well! Discharged "in plaster" August 5 1919. Went home. Wound broke down. Operation Charlesgate Hospital October 18 1919. Clearing out of joint, including massive synovial fat pads—antiseptics nothing radical done. A good deal of pannus present. Apparently the subchronic type of T. B. Semilunars removed, for good measure mainly.

Dressed daily to December 24 1919.

Report July 23 1919. Tuberculosis of knee (T. Leary).

Back to Northampton to Dr. Brown. Did badly. Joint went to pieces, slowly without obvious septic infection.

October 18 1919. Second operation, Charlesgate Hospital. Cleaning out of localized sloughing wound open to the front of the joint. Cleared up fairly well, never very well. General condition not satisfactory.

Sent back to Northampton December 24 1919.

Joint broke down about February 15 1920 with discharge of abscess. Progress thereafter unfavorable.

In Northampton an amputation was done about July 1 1920 with fair immediate result, I understand, gain in weight, etc. but the patient developed lung tuberculosis rapidly thereafter (November 8, 1920 pleurisy with effusion active T. B. of both

Not at all like the process in Case 83. Clinically a knee swollen, thickened, sore, not to be straightened, but with fluid and little spasm.

Diagnosed as *synovial tuberculosis*.

Operated May 5 1922 with usual dowel or 'rabetting operation, with very thorough enucleation of all synovial tissue. Put up at 20 degrees. No reaction at all. No oozing at any time. June 1 1922 seemingly solid. Out of bed.



Fig. 424—Case 87. Excision of knee for tuberculosis. Condition at three months.

Not yet walking but June 15 1922 shows pretty solid union, apparently no tuberculosis anywhere.

A curiously favorable case in its course. The *synovial* cases do well but rarely as well as this.

Case 87—J. L. Age thirty three. Laborer. In 1919 without injury began to have trouble in standing and the knee

Pathologists reported tissue with 'miliary tubercles abundant. Especially is this true near surface. Elsewhere widespread necrosis is present.' Diagnosis "Tuberculosis of knee (T. Leary)

He was put in a Thomas splint, did well except for a small pressure sore in crotch, and a pyelitis urine, with trace of albumin February 8 1922.

February 14 1922 Put up in plaster Slight subluxation backward For a few days past has had a little seropurulent drainage under the flap Union not bony but seems pretty solid No pain or tenderness. Put up in plaster because mental condition poor much noise and a little real delirium. I wanted to get him up and home. Has lately shown distinct *ecypsis* after these fits of howling, and consequent hyperpnea, with poor pulse and abdominal distention which to date are only temporary Argument of no result. Attempts to get rebreathing rejected by very "heady" patient. From this on he did badly mentally and presently physically

His temperature went up a bit there was a cough, but sputum showed no T. B. nor was the cough serious. Lungs negative A little drainage from under the flaps, but no more than is rather common in T. B. excisions of the knee.

He continued in partial delirium with frequent yelling fits of a quarter hour more.

Died February 16 1922 with some local sepsis, with a damaged heart and lungs of long standing but he died, as I visualize it, from mental upset (septic?) and consequent thrashing and yelling with the fatal result by way of asphyxia (loss of the body's  $\text{CO}_2$ ) a complex long ago shown up by Landell Henderson recognizable too little regarded by us clinicians.

Case 86—D. Man of fifty. Lame left knee for 22 months or more. Has continued at work with some difficulty. Seen as out-patient recommended. Boston City Hospital Entered May 1 1922.

x Rays showed vague absorption picture—first plate reported negative!

Asaphs, F. J. Cotton, Boston Med. and Surg. J. Soc.

V. Knee Excision for Trauma.—Case 89—Mrs. R. Referred by Dr ——— who is Case 78. Seen October 27 1921 Age fifty five. On December 21 1920 fell off a step-ladder Treated at Massachusetts General Hospital. Plaster eight weeks. A useless left knee in flexion with spasm, with a good bit of lost motion laterally x Ray October 28th (P F Butler) showed a fracture of upper end of tibia, an old T-fracture. Femur bears only an inner half of tibia Also a fracture of fibula 4 inches below its top solid not important (Fig 425)



Fig 425—Case 89 Old fracture, hopelessly useless limb. Excision. Good functional result.

Obviously could not make a knee of this. Sent to City Hospital. Admitted November 16 1921 Operation November 18 1921 Excision, rabbetted held by sutures only put up in flexion of about 20 degrees. No reaction at all. Up on December 13 1921 December 25 1921 flexion to 90 degrees. Discharged December 26 1921 January 20 1922 solid but question if union is bony Splint and crutches two weeks longer

March 25 1922 Beginning to walk with cane A good solid

swelled. Suddenly worse after a slight bump. Luetic history but has had treatment.

Entered Parker Hill Hospital No. 36 June 14, 1920. Muscle atrophy knee in flexion swollen hot, slightly red, not very painful but held in rigid spasm. Much capsular thickening. x Ray showed much bone damage.

Operation October 6 1920 Extraordinary amount of synovial thickening and necrosis. Type excision (not rabbetted) with fixation (deliberately at 180 degrees, for a *laborer* with an inch or more of bone removed) using ivory pegs for fixation.

This was in 1920 before I learned better

However he did very well though he leaked for a couple of weeks, beginning only after six weeks with solid healing thereafter March 7 1921 Solid useful knee

Case 88—J. A. Russian Jew Boy of fifteen years. Referred by the Children's Bureau Seen March 8 1922. History of disease of right knee beginning at about five years of age shortly before he came here. Little treatment but for last few months has been to the Massachusetts General Hospital under diagnosis of tubercular knee and has worn a cast without especial relief of the fatigue on walking, of which he complains.

Short, blocky sturdy boy Right knee shows a little flexion. Sharp knock-knee Motion to 60 degrees without spasm. A swelling or deep thickening, moderate quadriceps atrophy Evident old damage, very likely T. B. x Rays seem to confirm this.

At present suffering from knock-knee and a bit of permanent flexion. Put in Thomas convalescent caliper splint.

May 22 1922 Walking with far more happiness.

I expect to do a McEwen osteotomy on this lad to correct the knock knee the flexion is already cleared up. This has evidently not been an active pathologic process, whatever it was for years past merely *mechanical* disability to be recognized and treated as such.

It is not well to continue routine treatment based on pathologic diagnosis too long after the infective bacteria has quit

Y Plastic, Within Joint, for Trauma.—Case 91—D R. Examined December 29 1921 Machinist. Age thirty five. May 20 1920 heavy machine fell on him fracturing internal condyle of right knee. Treated at Morton Hospital Bed five weeks. Crutches four to five months. Knee flexed at 25 degrees. No extension beyond this, but flexion to beyond a right angle



Fig 428—Case 91 Condyle, inner has been broken and set up and back Fracture line indicated by arrows Leg cannot be extended nearer than 25 degrees from straight line, further flexion free enough. Compare not on C Fig 409

without pain Extension meets a bony lock. There is also a short tendo achillis Is practically disabled. x Ray showed lesion almost duplicating that of the last case (Fig 427)

Operation February 8 1922 Corner incision projecting portion of femur removed and smoothed to make a smooth joint surface of reasonable curve for the articulation. Washed and closed as usual. Temperature to 101.5 F on sixth day

joint still a bit tender. Should give a perfectly good working result with time.

**Condylar Fractures—Plastic Operations.**—Case 90—C. Age twenty-four. Inspection of ordnance. Admitted to No. 36. January 15 1920. Left knee injured July 1 1918 in fall. Now shows limitation of extension by about 30 degrees—a sharp bony locking. Also a very slight backward subluxation of leg. Some

crepatus (soft) on motion. x Ray shows (Fig 426) old fracture of condyles the back part driven up and back, with the tibia leaving a sharp-spurred shelf in front against which the tibia chocks up in attempted extension.



Fig 426—Case 90. Ray showing old fracture and absolute check on extension due to bony deformity within the joint.

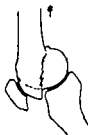


Fig 427—Case 90. Diagram of operation.

Operation January 30 1920. 'Corner incision. Extensive bone plastic removing the spurs, remodeling the condyles to a smooth curve.

February 24 1920. Cast off physiotherapy begun. March 7 1921 walks with slightest limp. Some discomfort cold days. Has practically full extension. Muscular development and power now nearly normal.

Thomas splint, under traction, and with cross-strapping (February 3 1922)

Discharged April 24 1922, with leg fracture solid Knee solid straight with about 20 degrees motion

Examination June 2 1922 shows solid union of leg Knee firm without abnormal lateral motion. Flexion as yet to 20 degrees only

In this case by efficient care open operation was avoided with at least as good a result as in the other 2 cases and with much saving in time.

Z. Arthroplasty — (For arthroplasty of patella only see Case 21)

Arthroplasty of the knee is an operation not much done hereabouts because of the poor average results. Instability of a weight bearing leg is too heavy a price to pay for motion, and until Putti showed us how that was the usual price I have not yet had opportunity to attempt Putti's operation

Case 93 — A. Young man of twenty years. Multiaxial subacute rheumatoid process of two years duration. Contractures, etc. as usual. Nearly a year ago had knees straightened x rays show bilateral epiphyseal separation. I did a Murphy arthroplasty on the hip and got 30 degrees of painless motion. Five months later did an arthroplasty on the left knee without infection or reaction. At three weeks a fresh attack of arthritis in all joints, and utter ruin of both operative results.

AA. Plastic Osteotomy Outside the Joint for Deformity — Case 94 — C Age seven Abscess on left knee at six months unknown pathology followed by irregular epiphyseal growth. Leg always weak and had an intermittent limp Gait at best clumsy

Examination showed moderate knock-knee a few degrees of permanent flexion. No paralysis fair musculature slight limp no shortening

x Ray showed same with uneven epiphyseal growth. No present pathology

Sent to City Hospital March 23 1922. Operation March 25 1922



after that normal. Little pain. No wound reaction. Motion started February 16th, that is, at eight days. At twelve days 10 degrees motion. February 26 1922 discharged eighteen days after operation, with 20 to 30 degrees active flexion and full extension. From this time on he was given active and passive motion, walked with crutches.

Began to use a cane April 1st. Examination April 24th showed gain in motion, but a bit of bow-leg deformity (always present because of removal of part of internal condyle) now



Fig. 429.—Both condyles similarly fractured and displaced. Shown for best possible reduction. Excellent limb resulted (Case 92)

tending to make him uncertain, though there is *no* lateral motion with the knee straight. A lift on the heel on the *outside* corrected this.

He now has (June 5 1922) a very fair leg with good motion. uses a cane but can go without and is steadily gaining. Bob fair to get a perfectly useful limb

Case 9 —C. Boy of fifteen. Admitted to B C H January 26 1922, showing almost exactly the same lesions in the knee also lower leg fracture on the same side (Fig. 429) This was reduced by very forcible manipulation and traction held in

Reported as not likely to return to work as a lineman in any case, but likely to be a useful citizen in some capacity if operated on.

Admitted to City Hospital February 3 1922 Operation February 4 1922.

Subcutaneous osteotomy (McEwen) across just above internal condyle Chiseled partway across then corrected by hand. Impaction successful. Correction rather exact (Fig 430)

Put up in Thomas splint. This removed February 18th "cast applied.

February 19th Crutches cast "bivalved."

February 21st Discharged

June 18 1922 Examined. Flexion to 20 degrees Walking with cane

Same lameness persists but is improving steadily

In this case it was a fair question whether to do an arthrodesis or the corrective osteotomy that was done Restoration of the joint or arthroplasty did not come in question.

Case 96—Miss J Age thirty four Old infantile paralysis of right leg No dorsal extensors left, not even the long extensor hallucis Little calf power quadriceps very weak, hip muscles weak, not paralyzed. Had always worn apparatus. Operated on first November 25 1921 to stabilize the ankle by reeving tendons through under the cortical layer of the tibial edge Good result so that Still has an in-knee deformity and knee shambles over inward as she walks the foot being everted, actual rotation deformity of the tibia. Discharged January 1 1922

Operation March 6 1922 Linear osteotomy of tibia (not fibula) about 3 inches below head Foot twisted in and adducted and best effort made to impact the fracture. This seems to have succeeded. Prompt consolidation. Discharged from hospital April 1 1922 April 25 1922 deformity satisfactorily corrected, both the knock knee and the rotation. Walks better though still not without a limp

Case 97—W M S Age forty four In a team accident

Linear osteotomy across just above internal condyle, subcutaneous.

About three-fourths circumference cut, the leg then "green stuck" to correct knock-knee and permanent flexion at same time. This done successfully with an apparently rigid impaction of the artificial fracture. Put up in cast.

April 1 1922 discharged



Fig. 430.—Case 95. Old fracture with fair knee motion, seen before operation. Treated by osteotomy. Fair result, but it is debatable if excision might not have been as wise, though he has his motion preserved.

Examined May 13 1922. Leg solid as timber, and still holds it stiff in part flexion, and has not yet regained a great deal of motion, but deformity fully corrected.

Case 95—G. Age twenty-six. Lineman. May 31 1921 jumped over fence and damaged right knee. In hospital six weeks. Crutches to September 1921. Examined June 12 1921. Showed marked knock-knee with flexion only to 15 degrees.

Seen by me tapping advised 90 c.c. straw-colored fluid removed. Culture showed *Streptococcus hemolyticus*

A small abscess over patella opened three days later

All joint symptoms subsided promptly and entirely despite the fact of an obvious generalized infection. Patient gradually failed, with temperature cough, weak heart action, and finally died January 17 1922 of a terminal pneumonia.

But there had been no recurrence of joint symptoms

Case 100—M. H. Age ten.

Following a slight blow had a knee effusion apparently ordinary synovitis, which after just a week seemed to be doing poorly and September 26 1921 I saw her in consultation with Dr. Bradford Kent, found a joint tense with fluid and a thickened upper popliteal region. Removed to hospital.

Operation September 27 1921. Knee joint opened, irrigated for fifteen minutes with corrosive salt solution 1:15,000 and closed. Separate incision from outer side opening up the outer side of the popliteal space. Small abscess with half-organized walls just above upper outer part of epiphyseal line. Small area of denuded bone. Cleaned out. Dakin tubes inserted. Cultures showed *Staphylococcus pyogenes aureus* of both joint fluid and from abscess. Regular instillations of Dakin solution every two hours. Sent home with wound nearly healed October 12, 1921. Arrangements for massage etc.

December 10 1921. Solidly healed full motion of joint and no lump. There was no sequestrum formation.

From three days after operation with subsidence of the reactive effusion (always present in these irrigated cases for a few days) the knee ceased to be a factor in the case.

Case 101—E. B. Age twelve. Admitted September 12 1921 to City Hospital. Two weeks ago scratched left knee. Three days ago after jumping it swelled, got red, and painful. Presently unable to walk. Sent in by his family doctor.

On admission showed septic abrasions over patella. Knee-joint swollen, tender motions limited. x Ray negative.

This is the technic reported by me in *Disinfection of Septic Joints*, Boston Med. and Surg. Jour. *Claudi*, p. 903, December 16, 1915. With 6 cases.

June 26 1917 Lacerations of left knee, which became septic. Treated at Waltham Hospital and at Massachusetts General. Examination on admission to Parker Hill January 12, 1920 showed very extensive and deep scars on outer side of knee and in popliteal space. Permanent flexion of 30 degrees, joint free for motion 10 degrees or so beyond this. Joint lame. Thins easily. Unable to work.

Operation January 16 1920 Tenotomy hamstrings, stretching Plaster to February caliper splint, P T treatment to March 9th. Treatment a failure.

Operation June 22, 1920 Supracondylar osteotomy correction. Recovery uneventful. Union firm at eight weeks.

Examination March 7 1921 Has straight leg and about 15 degrees motion, but the joint is tender and lame and at some time in the last year he has continued to acquire a partial toe-drop possibly from callous pressure. Unable to do his regular work.

This case is a failure. He should have had an excision, which was considered but not done on account of the dense scars more than half encircling the joint.

Case 98—J H. Age eighty-three. Admitted to City Hospital April 6 1921 Working last week, cut left knee with knife paid no attention till yesterday when it began to pain. Typical septic prepatellar bursa.

Operation April 9 1921 Gas anesthesia. Opening gave exit to 1 ounce of pus.

Cellulitis of upper part of leg developed and presently an area of fluctuation, which was opened April 17 1921 April 29th discharged practically well.

Case 99—C K. Age seventy-seven. Shoemaker. Admitted to City Hospital December 14 1921 Two months before entrance fell and lacerated outer middle portion of right leg. Gradually worse. On entrance presented several small ulcers on leg up to a half-dollar size. Small become evacuated over skin two days after entrance.

December 18th temperature to 101 F December 20th knee joint swollen, red, tense with fluid. White count 10,000

Did not clear up promptly Aspirated May 5 1921 75 c.c. of pus withdrawn which proved to contain *Streptococcus hemolyticus* (at this time *Streptococcus hemolyticus* from the osteomyelitis sinus also)

Improved promptly

May 25 1921 Up in chair

Since then the history has been one of osteomyelitis with sinus not yet cleaned up The knee joint is mobile to near a right angle without adhesions limitation due to thickening of osteomyelitic process. Walks well.

June 24 1922 Sinus closing No bare bone to probe. Walks without lameness.

*Case 103*—M P Age seventeen. Telephone operator Admitted February 25 1922 to City Hospital. Accidental gunshot wound Punctured wound of inner part of right thigh just above knee. Bullet palpable over patella.

Operation February 26 1922 Ether Wound opened bullet removed joint found opened Iodin and alcohol Alcohol wick in wound to just under skin. No reaction.

March 12 1922 Discharged. Home Perfectly good knee

This case never got infected presumably due to thoroughness and promptness of cleaning out.

*Case 104*—DeM Age forty-one. Old osteomyelitis of left femur near knee For many years has walked on flexed knee Admitted to City Hospital December 28 1921 with acute upset. Operation Cleaning up of old sinus in popliteal space. Dakin's tubes. For some weeks kept under Carrell Dakin treatment and presently put in a Pearson-Thomas splint to minimize flexion by steady traction. This worked well, and he was discharged March 3 1922 with a minimal sinus but without bare bone and with a knee flexed at 20 degrees instead of the 40 degrees flexion with which he came to us.

*Case 105*—F DeM Age seven. Gunshot wound of right knee treated at Relief Station. Admitted to City Hospital February 26 1922 Temperature 100.5° F Cleaned up washed, Dakin treatment Dakin treatment to June 1 1922. June 10 1922 manipulation under gas. Knee mobilized to 180 degrees

Operation September 16 1921 Dr Fraser Joint opened, thick, creamy pus. Irrigated with 1 15,000 corrosive Capsule sutured tight.

Culture *Streptococcus hemolyticus*.

September 18 1921 Temperature still to 101 F White blood count 18 400 Joint tender

September 24 1921 No better

Operation September 30 1921 Dr Scannell Joint opened. Corrosive irrigation. Dakin treatment.

Pathologic report *Staphylococcus aureus*.

October 3 1921 Not doing well, swelling above joint.

Operation October 3 1921 (Cotton) Incision at outer side, opening up a big abscess in the intermuscular planes. Dakin treatment.

November 1 1921 Some motion. Temperature and white count dropped to 9600 and to normal day after last operation, and have stayed there.

November 8 1921 Up in wheel chair

November 21 1921 Wounds healed. Considerable range, active and passive motion.

Case 10. —A. G. Age thirty two Admitted April 7 1921 Kicked in right knee twenty-two years ago. Fell and hurt knee no wound. Joint became tender and warm to touch. Two weeks after injury pus began to run from knee.

On admission knee showed swelling, tendering pus from a small popliteal sinus.

Operation April 7 1921 One inch incision into popliteal abscess.

x Ray showed the lower third of femur thickened, etc. In short, an old osteomyelitis

Drained without much change

April 26th sudden swelling of knee joint and rise of temperature to 101.8° F which persisted with remissions.

Operation May 1 1921 (Cotton) Joint opened. Thin pus. Washed out for fifteen minutes with 1 15,000 bichlorid salt solution. Capsule sutured as usual. Soft parts left open

Culture showed *Streptococcus hemolyticus*.

After ten days it was evident that the joint was open.

All things considered especially the area of the wound and the unsatisfactory physical and mental condition of the patient it was decided to do a midthigh amputation. This was done, and with excellent result.

The interesting factor in this case was the difficulty in diagnosis. For many days one could not tell whether this deranged joint was open or not.

Septic joints not under tension *do not show muscle spasm*

It is very difficult therefore to be certain whether a wide wound about the joint involves the joint itself for there is no reflex spasm no pain, no physical signs crepitus, or the like and unless one can express synovial fluid from the joint—as was done in this case—the diagnosis is one of inference and very uncertain.

*Case 109*—V C Ex-soldier Parker Hill. Gunshot wound of right knee, treated with Dakin solution and brought to a clean closure of the wound. There was, however a considerable loss of bone about the external condyle and despite well-fitted apparatus the patient was readmitted in 1921 for further treatment.

There was a half joint without motion and with the external condyle half-missing. Low thigh amputation advised and done with satisfactory result. This is one of the cases in which a triumph of modern treatment was of no practical value.

The last class to be considered is that of the tabetic knees. We have learned of late that these cases under proper anti-syphilitic treatment and careful mechanical support do rather well. There is, of course, a destructive process that we cannot check, but there is also a process of repair that, under due protection, is very efficient.

*Case 110*—G W Seen December 8 1919 about right knee, a twist showed an obvious Charcot joint. Protected with a caliper splint, put through intensive 606 treatment. He has improved very slowly but steadily and now has a fairly stable joint, not good enough as yet to go without support, but very definitely better than it was three years ago.



flexion free to about 40 degrees. No great force used. Caliper splint to hold the gain.

*Case 106*—D. C. Age ten. Scarlet fever and streptococcemia with ears etc. Developed a pus knee. Seen with Dr. Place, South Department. Operated January 14 1921. Knee full of pus, ether washed as usual with corrosive 1:15,000 for fifteen minutes and closed. Boy in desperate condition. Did badly. Pus reaccumulated from a primary bone infection, as proved later in the external tibial tuberosity.

Joint eventually had to be drained February 10, 1921. Wide open Carrell Dakin treatment. Closed within a month.

September 23 1922. Ether manipulation to overcome right angle flexion due to neglect. Joint came straight put into caliper splint. There was almost no reaction following the manipulation. Is being treated with more neglect. I have been unable to get hold of the lad for months.

This is a case of healing by modern Dakin treatment, but without restoration of joint function.

*Case 107*—W. McC. Age forty-two. Acute arthritis of right knee. Operated, washed out, sewed tight. Cultures showed *Streptococcus hemolyticus*. Joint filled up again, broke down, and was opened, drained, and Carrel-Dakin treatment carried out.

This case had *secondary* necrosis of the patella and was operated on for removal of the necrosed patella. Dakin treatment then carried out for three months.

Healed, but without much motion, in spite of careful carrying out of the Willems technic.

If one can get fairly prompt disinfection by the use of the Dakin two-hour instillation and can *throughout* keep up motion in the joint, there is at least a fair chance of saving a useful joint.

This man has today, after eighteen months, a few degrees of motion and a fairly servicable limb. Some of the others have done better.

*Case 108*—R. Parker Hill Hospital. An army case injured in an auto smash, long ragged wound of outer side of left thigh and knee. Dakin treatment from the start.

To sum up

- 1 More efficient treatment cleans up the innumerable cases of synovitis promptly
- 2 Operations on the knee do better under proper exposure (Corner technic) with adequate after-care.
- 3 Such operations do better if removal of fat pads is made the routine.
- 4 Osteochondritis cases are not rare if one opens up and looks for them. The x ray evidence in these cases is not conclusive.
- 5 Ligament repair is practical the technic here described is probably original
- 6 Patellar luxation can be cared for far better than we have done it in the past.
- 7 For all reparative reconstructural operations in the joint the most important item is *early use*. Mobilization not after a month but in three to five days whenever possible and it is usually possible

We have not in the past recognized the reparative power of these tabetic cases.

In one case of the sort, now six years under observation, I have had the chance to watch the formation of a new hip-joint. The patient, a successful business man very active has good function, no pain and his locomotor ataxia has made no appreciable progress in the half-dozen years.



Fig. 431. —Charcot joint. In the left-hand figure one sees only the distention of the joint below the patella and vague shadows, rather dense in the regions pointed to by the arrows. The bone changes, such as they are in this stage definitely hypertrophic not characteristic of the Charcot joint. Nevertheless, at this stage the clinical diagnosis was not in doubt. The second plate, five months later shows the end-product of ankyrosis and protection against undue trauma. A fairly stable joint with some motion. Patient still wears apparatus, but with it is rather active. For year or two the process has been reparative, not destructive. All.

It is odd, but true, that Charcot joints occur early in locomotor ataxia in cases that often enough show only a doubtful Argyll Robertson pupil and a diminished knee-jerk the cases are, therefore, very easily and commonly overlooked.

When one looks all this over there is nothing very remarkable in it. It is essentially a résumé of what today is nearly all accepted practice.

CONTRIBUTION BY DRS J DELLINGER BARNEY  
AND WM M SHEDDEN

MASSACHUSETTS GENERAL HOSPITAL

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A STUDY OF ANESTHESIA IN PROSTATECTOMY

It is the belief that an occasional check up of one's work is of definite value to those who have done the work and of possible interest to others, we have undertaken a study of 250 patients operated for different types of obstructing prostate in the Genito-urinary Service of the Massachusetts General Hospital.

There seems still to be a difference of opinion as to the choice of anesthesia in prostatectomy. Some persist in the use of ether others prefer spinal anesthesia while there are others, of which our clinic is an example who use whatever anesthetic seems best suited to the individual case. The fact of the matter is that none of the anesthetics now in use are ideal, although this goal may be reached some day possibly in the form of sacral anesthesia.

This study has, therefore, been undertaken entirely from the viewpoint of anesthesia in relation to the group. At the outset certain difficulties and discrepancies must be acknowledged. The incompleteness of records has proved somewhat of a handicap but, more important still, is the fact that it is impossible to express in any kind of record no matter how complete just what sort of a surgical risk each case appeared to be.

The fact that these cases were pretty generally divided between our staff of 5 or 6 surgeons gives a chance to view the combined results of all. It is also of value from the fact that during the past few years prostatectomy has undergone many changes in the matter of anesthesia operative technic, and preoperative as well as postoperative care.



adenoma there was a mortality of 17.8 per cent. consisting of 34 cases. It would, therefore appear that the odds are against the patient with a cancerous prostate.

Hemorrhage was a definite factor in 27 or 10.7 per cent. of all cases. It was a postoperative event requiring surgical intervention in some 13 times. In the remaining 14 the description of the operation left no doubt that the hemorrhage was unusually severe and required definite measures for its control. It has already been stated that it was the cause of 6 deaths.

Pneumonia was noted in 32 cases (12.7 per cent.) but the onset of this disease in relation to operation could not be determined in most. As already stated it was fatal in 7 cases.

Our greatest difficulty was in determining what sort of a risk from an operative standpoint, each case was. After various methods of estimating this point we finally hit upon a plan which was workable and the results of which seem to be reasonably accurate. Realizing that statements of opinion were too infrequent and too inadequate we decided to rely only upon statements of fact namely blood pressure condition of urine phenolsulphonephthalein excretion and estimation of non protein nitrogen. The general appearance of the patient as stated in the record was ignored except in those cases where it was said to be 'bad'. The factors enumerated were divided into three groups numbered 1, 2 and 3 the lower figure representing the most favorable condition. Blood-pressures between 130 and 160 systolic were put into the first column, those between 115 and 130 or between 160 and 180 systolic into the second column and those below 115 or over 180 systolic, into the third column. This division while purely arbitrary seems to us to be a fair method of estimation. In the case of the urine when it was 'negative' or contained but a few blood- or pus-cells it was put in column 1 when pus or blood or both were present in 'moderate' quantities the second column was used whereas when either or both elements were found in abundance or when sugar was present it was placed in column 3. If the phthalein output was 30 per cent. or more this was recorded in

The analysis of these 250 patients taken as a whole offers some points of interest. The average age was between sixty-two and sixty-three years the youngest being forty-one the oldest eighty-three. The blood-pressure was found to be 150 plus systolic, 84 plus diastolic, each figure being an average for the group. There were 251 anesthetics, consisting of spinal in 101 nitrous oxid-oxygen in 78 ether (with or without preliminary nitrous oxid) in 68 and local anesthesia (infiltration of the gland and sacral) in 4. The mortality of the whole group was 18.8 per cent., consisting of 47 cases comprising 28 spinal anesthetics, or 27.45 per cent. 11 ethers, or 16.1 per cent., and 8 nitrous oxid-oxygen anesthetics, or 10.2 per cent. An examination of the causes of death has been somewhat difficult for the reason that it was not definitely stated in some instances, while in others the patient had so many ailments, any one of which might be fatal that it was sometimes impossible to decide which lesion closed the scene. Such as they are however the figures show sepsis was the predominating factor occurring in 20 cases (42.5 per cent.) disease of the respiratory tract (pneumonia) was the chief factor in 7 hemorrhage in 6 renal insufficiency (uremia) and circulatory disturbances (embolus, apoplexy myocarditis, etc.) in 5 cases each. In 4 instances it was impossible to determine the cause of death.

Of the 251 operations, 48 were of the one-stage perineal type and 6 of the two-stage perineal type, giving a total of 54 or 21.1 per cent. of the whole. Suprapubic operations were done 197 times (79.9 per cent.) by the one-stage method in 117 cases, and by the two-stage method in 80. It may be said that although the one-stage suprapubic operation has been done more often it includes mostly the early cases, whereas the two-stage operation has been done almost exclusively in the later years.

Pathologic reports were recorded in 228 cases showing adenoma in 193 carcinoma in 34 (14.9 per cent.) and sarcoma in 1. In this connection it is extremely interesting to find that of the 34 carcinoma cases there were 10 deaths giving a mortality of 30.3 per cent. for this group whereas of the 193 cases of

The pathologic reports showed the percentage of cancer to be 11.2.

Severe hemorrhage at the time of operation was noted in 6 and occurred during convalescence in 7 a total of 13 cases or 12.8 per cent. In 3 cases it was the cause of death.

Pneumonia occurred in 15 cases or 14.8 per cent. and terminated fatally 5 times.

By our method of estimating this point, 35 or 38 per cent of this group were found to be "good risks, 37 or 40.2 per cent. "fair" and 20 or 21.7 per cent. "bad risks.

Of special interest and importance is the fact that 10 patients had what, for want of a better term we have called spinal reactions, and of this number 5 died, 2 the same day or the day after operation 3 at later intervals.

In view of these unfortunate occurrences we feel that we must go into the details of the situation. Of the 101 cases 29 were given tropococain, 26 novocain, 16 apothesine 8 novol, 3 procain. The drug employed was not stated in 19 but as these were among the earlier cases, it is probable that tropococain was used. Of those having a reaction tropococain was used in 4 novocain in 2 apothesine in 3 and procain in 1.

Where tropococain was used the dose varied from 1 to 2 c.c. In the case of novocain 2 (sometimes 3) "C" tablets were used. Novol and procain, being essentially novocain with a special trade name, were used in the same strength. Apothesine was given in 5 per cent. solution 2 c.c. of this being used in most cases. In most the spinal needle was inserted in the space between the third and fourth lumbar vertebrae, and enough spinal fluid withdrawn into the syringe to make a total of 3 to 4 c.c. (including the anesthetic) of fluid which was reinjected into the spinal canal.

The reaction varied all the way from nausea and vomiting sighing respiration and a soft slow pulse (these phenomena occurring within a few minutes after the administration of the anesthetic and lasting during the operation and for a few hours after) to most alarming symptom-complex. When well marked this consisted of incontinence of feces cyanosis, profuse sweating,



column 1 between 30 and 40 per cent. was placed in column 2, and anything below 30 per cent. in the third column. Non-protein nitrogen was placed in the first group when between 30 and 40 mgm. per 100 c.c. of blood in the second group when between 40 and 50 mgm. while any figure higher than this went into the last column. Where the general appearance of the patient was described as being unmistakably 'bad,' it was put in the third column. Each patient's risk was then worked out by this scheme the figures added up, and recorded under "good," "fair," or "bad." In this way it was found that 78 or 34.9 per cent. were good risks (*i. e.* considering the fact that they were old men with damaged organs) 104 or 46.6 per cent., were "fair" risks, and 41 or 18.3 per cent. were "bad" risks. When it is considered that all these cases were of the usual hospital class this division would appear to represent the facts fairly accurately.

The relationship of "risk" and mortality was then investigated. Of the 47 deaths it was impossible to estimate the type of "risk" in 3. Among the remaining 44 about whom there is definite information 13 or 29.5 per cent. were considered as "good," 18 or 40.9 per cent. as "fair" and 13 or 29.5 per cent. as "bad."

As our object in this paper is to determine so far as possible the relation of anesthesia to prostatectomy the patients have been divided into groups according to the type of anesthetic employed.

As already stated 101 patients were given spinal anesthesia. Their average age was 64.5 years, their average blood-pressure 142 plus systolic, 82 plus diastolic. Twenty-eight died, 6 within forty-eight hours after operation (21.4 per cent.) 22 at later intervals giving a total mortality of 27.45 per cent. The causes of death so far as could be determined were as follows: sepsis, 12 (42.8 per cent.) respiratory 5 circulatory and hemorrhage, each 3 renal 2.

Perineal operations were done in 30 with 9 deaths, 30 per cent. suprapubic operations in 71 (32 two stage) with 19 deaths or 26.7 per cent.

better risk than his brother who received spinal anesthesia, for it was found that he was considered to be a 'good' risk in 34.4 per cent, a 'fair' risk in 53.4 per cent, and a 'bad' risk in 12 per cent.

Seventy-eight patients were given nitrous-oxid-oxygen anesthesia. The average age of these men was 64.2 years and their average blood-pressure 148 systolic, 86 diastolic.

Of this group only 8 died giving a mortality figure of 10.2 per cent. There were no operative deaths, all occurring days or weeks after operation.

Among the causes of death sepsis again takes the lead with 3 cases (37.5 per cent.) circulatory disorders in 2 while renal insufficiency and respiratory lesions each furnished 1 death. It is notable that no death resulted from hemorrhage early or late.

The pathologist reported cancer in 17.5 per cent. of cases and found 1 case of sarcoma.

Pneumonia intervened in 13 or 16.6 per cent. of this group but resulted fatally only in 1 case.

The incidence of hemorrhage is interesting in that it was recorded as being of unusual severity at the time of operation in 6 and occurred during convalescence in 2 giving a total percentage of 10.2. The greater frequency of hemorrhage during operation may perhaps be accounted for by the increased venous congestion occasioned by the anesthetic.

The perineal operation was employed in this group but 7 times with 1 death (14.2 per cent.). Suprapubic operations were performed upon 71 of these patients (the two-stage type in 24) with a mortality of 9.85 per cent. consisting of 7 cases. According to our estimate of the risk 31.5 per cent. were considered good, 49.3 per cent. 'fair' and 19.1 per cent. 'bad.'

Only a word can be said of the 4 cases having local anesthesia. In all a two-stage suprapubic operation was done. In 3 the prostate was removed after infiltrating the region of the gland with pothesine using a spinal needle attached to a 10-c.c. syringe. The anesthesia was not entirely satisfactory in 2 but in the third case is recorded as "good." In a fourth case sacral anesthesia (drug not stated) was employed with

thready soft slow pulse sighing or gasping and shallow respiration, restlessness, and stupor. In a great many of the cases to whom spinal anesthesia is given a marked and sudden fall in the blood-pressure, both systolic and diastolic, takes place. In those having the reactions the blood-pressure a short time after the anesthetic was given was in several so low that it could not be recorded. We know of no more disconcerting event than the advent of the phenomena described, nor do we feel able to predict its onset in any given case. The 10 patients who exhibited the symptoms described were considered 'good' in 2 'fair' in 5 'bad' in 3 (a proportion comparable with that of the whole group) and were in other respects not essentially different from the others who did not react unfavorably. Blood-pressure does not seem to be a factor as in certain of the group not reacting unfavorably to spinal anesthesia it was only 100 mm. or thereabouts, and in the neighborhood of 200 mm. in others.

Turning now to the group which had ether or nitrous-oxide-ether anesthesia, there were 68 of these. Their average age was 60 plus years, and their average blood-pressure 155 systolic, 86 diastolic.

Eleven of these cases or 16.1 per cent. died 3 within forty eight hours after operation, 8 at subsequent times. The lower mortality of this group as compared with the spinals is to be noted. Five of these men died of septicemia (45.4 per cent.) 3 of hemorrhage 2 of renal insufficiency 1 of respiratory disease.

There were only 4 pneumonias 5.8 per cent. as compared with 14.8 per cent. for spinal, and only one of these died.

Cancer was found in 16.3 per cent.

Hemorrhage at the time of operation was noted in 2 cases, and as a postoperative event in 4 a total of 6 8.8 per cent. This figure is again lower than that for spinal anesthesia.

There were 17 perineal operations without a death 51 were operated by the suprapubic route (20 two-stages) with 11 deaths giving a death-rate of 21.5 per cent. for this type of operation.

The man who was given ether appeared to be somewhat

with the use of spinal anesthesia and gas-oxygen, and comparative infrequency when ether is used. It is also to be noted that those having spinal anesthesia not only bled more frequently than the others, but did so about as much after as during operation.

Figure 435 shows beyond question that septicemia far outnumbered all other causes of death not only in the entire group of 250 patients but in the spinal group as well. The small



Fig. 434.—Hemorrhage percentages. 1, Spinal anesthesia. 2, Ether. 3, Gas-oxygen. Unshaded portions indicate no intra operative hemorrhage.

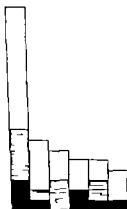


Fig. 435.—Causes of death. Columns show percentage and actual numbers. 1, Septicemia. 2, Respiratory disease. 3, Hemorrhage. 4, Circulatory disease. 5, Renal insufficiency. 6, Cause undetermined. Heavy shading, gas-oxygen; light shading, ether; white, spinal.

number of deaths from respiratory disease when ether was given is worthy of comment, and this anesthetic is completely guiltless of producing death by circulatory disturbances.

Figures 436-439 are an attempt to show not only the comparative numbers of good, fair, and bad risks but also the kind of anesthetic given to each. The latter point is a matter of fact; the former is admittedly a matter of more or less doubtful accuracy. We present our estimate for what it

"excellent" results. None of these cases died nor was their convalescence any different from that of many others. The anesthetic was employed solely for the purpose of trying it out.

A glance at the accompanying charts will show better than in any other way the essential differences not only in the type of men composing the three main groups of anesthetics, but also the incidence of other important items.



Fig. 432.—General mortality percentages. 1, Spinal anesthesia. 2, Ether. 3, Gas-oxygen. Unshaded portions indicate deaths within forty eight hours.



Fig. 433.—Pneumonia percentages. 1, Spinal anesthesia. 2, Ether. 3, Gas-oxygen.

Figure 432 presents in a striking manner the great difference in the mortality of the three groups.

Figure 433 shows equally clearly the incidence of pneumonia, especially its surprisingly low percentage, in the ether group.

Figure 434 presents the story of hemorrhage in such a way as to emphasize its considerable frequency during operation.

is worth with full recognition of the fact that no accurate figures are possible. It must not be forgotten however that right or wrong the same method of estimation was applied to all cases a point which makes us confident that the results shown in these four charts may have some element of truth.

While it may appear from this paper that spinal anesthesia is a most dangerous proposition we do not believe this to be true. There is no doubt that if given improperly as regards either dosage or technic it is quite capable of resulting disastrously. The high mortality here recorded is we believe due not to the anesthetic or to the way in which it was given but to the type of patient to whom it was given.

We have shown that the age and blood-pressure was essentially the same in all groups. It was shown that cancer figured even less among the spinal group than among the others. It was also demonstrated in the best way we could devise that the man who was given spinal anesthesia was a fair or bad risk in about 61 per cent. of cases, whereas in the ether group he was so recorded in 65 per cent. and in the gas-oxygen group in 68 per cent. It is also true that the men who received spinal anesthesia outnumbered either of the other two groups in the matter of "good" risks.

On the other hand when we consider what happened to the man who was given spinal anesthesia we are confronted with the fact that regardless of whether he was a "good," "fair" or "bad" risk by our method of estimation he certainly developed pneumonia with great ease dying of it in more instances than those in the other groups. hemorrhage, both operative and postoperative, was a prominent feature and finally he yielded to septicemia in more instances than did any of his mates and died of it in nearly 50 per cent. of cases. Finally he died far more frequently than did the patient who was given ether or gas-oxygen. In other words the trouble was with the patient and not with the anesthetic and we feel justified in saying that had he been given ether or gas-oxygen instead of spinal anesthesia this particular type of patient would have died in even greater numbers. In other words this particular type of patient



Fig. 436—Total risks lib anesthetic given. Columns represent percentages. 1, Good. 2, Fair. 3, Bad. Heavy shading, gas-oxygen. Light shading, ether. hite, spinal.



Fig. 437—Good risks and anesthesia. Columns represent percent ages. Heavy shading, gas-oxygen. Light shading, ether. hite, spinal.



Fig. 438—Fair risks and anesthesia. Columns represent percent ages. Heavy shading, gas-oxygen. Light shading, ether. hite, spinal.



Fig. 439—Bad risks and anesthesia. Columns represent percent ages. Heavy shading, gas-oxygen. Light shading, ether. hite, spinal.

CLINIC OF DRS ELLIOTT C CUTLER AND JUDSON A.  
SMITH

PETER BEET BRIGHAM HOSPITAL

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LYMPHOBLASTOMA OF THE STOMACH:  
REPORT OF TWO CASES\*

LYMPHOBLASTOMA of the stomach is a relatively rare tumor. However, with improved histologic methods it is being found more and more frequently and one may suppose that in earlier times it was now and then mistaken for carcinoma. Ruppert<sup>†</sup> collected 12 cases from the German literature in 1912 and added 1 of his own. Broders and Mahle<sup>1</sup> report 12 cases occurring in the Mayo Clinic between January 1913 and December 1920. This was in the proportion of 1 lymphosarcoma to every 68 gastric carcinomata. Of all forms of gastric sarcoma the lymphatic type is the most frequent. Haggard<sup>2</sup> reviews 107 operated cases of sarcomata of the stomach, of which there was a microscopic report in 76 cases. Of these, 30 are classified as lymphosarcoma, round-cell sarcoma, small round-cell or large round-cell sarcoma etc. terms which represent a tumor of lymph-cell origin. The remaining cases are classified under a heterogeneous terminology the names of some leaving much doubt as to whether the tumors were true sarcomata.

From Haggard's report it is evident that the tumors of lymphatic origin are prone to metastasis. Of the 12 cases reported by Broders and Mahle only 6 were considered operable.

From the Surgical Clinic of the Peter Beet Brigham Hospital.

† This terminology is based on Mallory's plea that we should base our classification of tumors on histogenesis. If later the cause of tumors is worked out, we might then find an etiologic classification more desirable. The present indiscriminate use of the term sarcoma has brought much confusion.



was a bad risk from any standpoint, and would probably die after operation regardless of what anesthetic he received.

In closing we wish to state that we have purposely avoided drawing conclusions except in a few instances. The facts are presented solely on their merits the reader being asked to make whatever deductions he can.

Our experience with prostatectomy among 250 cases of the hospital class shows that—

1 The gross mortality is 18.8 per cent. of which those dying after spinal anesthesia form the large majority for the reason that they are the poorest risks. But when it is recalled that about four-fifths of the deaths among the spinal group died several days or weeks after operation it is clear that one cannot lay this mortality at the feet of the anesthetic. One must look for and actually find other causes which would indicate a very low resistance on the part of the patient to the various ills to which an old man is heir.

2 Cancer is found in about 15 per cent. of cases.

Nearly one-third of these cases died as compared with less than one-fifth of the adenomas.

3 Pneumonia occurs in about 13 per cent. of cases.

4 Hemorrhage is to be expected in about 10 per cent. being an incidence of convalescence in about half this number.

5 Septicæmia causes over 40 per cent. of the deaths, with diseases of the respiratory tract, hemorrhage and diseases of the circulatory and urinary organs next in order.

6 In any considerable group of spinal anesthetics an incidence of nearly 10 per cent. of "spinal reactions" is to be expected of which some are fatal.

7 In spite of its high mortality we believe that spinal anesthesia, given under proper conditions, is a safe and most satisfactory anesthetic.

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REPORT OF TWO CASES

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and of these 2 died of sepsis following operation 1 died four months later with general recurrence of the disease 2 returned in from five to seven months with evident metastases, and 1 was operated upon too recently to justify any conclusions. Morris, in a report of a single case comments on the prognosis of these tumors in general saying that the average expectancy of life following operation is fifteen months. This must depend, however upon the stage of growth of the disease in each instance. For although all lymph-cell tumors usually metastasize early the fact that 1 of the 2 cases herewith reported is apparently well twelve months after the operation is evidence of some variation in the malignancy in individual instances.

The diagnosis rests on the signs and symptoms usually presented by gastric carcinomata. Loss of weight, asthenia, anorexia, and a sense of a mass or discomfort in the epigastrium may be the only warning and these symptoms will usually occur only when the disease is relatively far advanced. The differential diagnosis from cancer is practically impossible. Hemorrhage and anemia however are not so common as in carcinoma because of the tendency for the mucous membrane to remain intact. Gastric analysis reveals the same findings as in cancer. The x-ray alone may give a clue to the differential diagnosis, since the tumor commonly projects into the lumen of the stomach rather than produces an ulcer with the resultant "filling defect." The same stiffness of the gastric walls is produced, but there is less tendency to obstruction. The disease commonly runs a more rapid course and short history with a palpable smooth tumor and no ulceration demonstrable by the x-ray is certainly more characteristic of sarcoma than cancer.

Such tumors have been classified as endogenous and exogenous, but the wealth of possibilities for primary disease is so great it would seem as if the exogenous type must be rare. The submucosa of the entire gastro-intestinal tract is liberally supplied with lymph-follicles. These are abundant in the stomach and from reports it would seem as if most of these tumors had origin here. Analogous tumors in the intestines are not common yet Graves<sup>1</sup> was able to assemble 246 cases of lymphoblastoma of

the intestine in 1919. He reported 3 cases which he had the opportunity to study and the gross and microscopic descriptions he submits are not very unlike the tumors we present at this time. In his cases generalized infiltration and lymph-node involvement were marked characteristics.

Both of the cases herewith reported were diagnosed as cancer before operation. Of the 12 cases reported from the Mayo Clinic, 7 were diagnosed as carcinoma, 1 as ulcer, 1 as abdominal tumor probably inflammatory, 1 as a gastric lesion, probably malignant, 1 as pyloric obstruction and 1 as an upper abdominal tumor probably of the pancreas.

#### REPORT OF CASES

Case L—S M P B B H. No. 28132. The patient, a Nova Scotian of fifty nine was admitted to the hospital February 9 1921 with the complaint of loss of appetite. The family and marital histories were negative. There was nothing of importance in the past history. There had been no gastro-intestinal symptoms previous to the present illness. There was no history of venereal infections. Habits were good. He was employed as a carpenter.

The present illness began seven months before admission with progressive loss of appetite. For the two months preceding admission he had taken almost no nourishment, being nauseated even at the sight of any kind of food. With the beginning of this anorexia he noted slight crampy epigastric pain beginning shortly after taking food and again independent of food when changing position in bed at night. The pain was never severe nor did it have any radiation. The patient had gradually become weaker and two months before admission had had to give up his work entirely. He was very restless at night and for the month before admission had little sleep. He had never vomited, though frequently nauseated. Bowels had always been regular until he restricted his diet. No abnormal stools had been noted. His weight had dropped from about 135 pounds at the onset of his illness to 120 at admission.

Physical examination showed a very emaciated patient.

There were many carious teeth and pyorrhea. The tongue was coated and the breath foul. Lungs and cardiovascular system were negative. The abdomen was soft and symmetric. There was no shifting dullness. High in the left epigastrium could be felt the lower part of a firm and slightly tender mass apparently



Fig. 440.—Radiogram of stomach, Case 1 February 2, 1921, before operation. Stomach mucospleth filled but as low thin stream of barium is held in the lower esophagus and the lower curve are at the cardiac orifice is displaced to the left and fluoroscopically seemed fixed and unstable.

the size of an orange which seemed to move with respiration. Otherwise the examination was negative.

The urine was negative. The hemoglobin was 75 per cent (Talqvist) the red cell count 4,168,000 the white cell count, 8800. Gastric analysis showed an absence of free hydrochloric acid in all the specimens and low total acidity. The stool ga-

a negative beundin test.  $\alpha$  Ray examination of the stomach (Figs. 440-441) showed a filling defect high up on the lesser curvature in the cardiac portion of the stomach. There was no constriction of the cardiac orifice but the stomach was displaced anteriorly and toward the left side by the mass. The



Fig. 441.—Radiogram of stomach. Case I. February 14, 1921, before operation, patient lying on back. Stomach displaced, left filling defect high on lesser curvature in the cardiac portion of the stomach.

fixation and irregularity in outline of the stomach suggested a malignant lesion.

A diagnosis of gastric carcinoma was made and though the case was thought to be inoperable the chance afforded by exploratory operation was offered the patient and was accepted.

Operation (February 17, 1921). A median epigastric incision was made. On opening the peritoneum there appeared a mod-

erate amount of watery slightly turbid fluid. The stomach presented distended with gas and with marked passive congestion of its veins. The pylorus was extremely wide, the ring being scarcely palpable. The duodenum and the head of the pancreas were negative. The gall-bladder was of normal size not adherent, and contained three calculi the size of hazelnuts. The liver showed no metastases. High up in the epigastrium was a mass, apparently retroperitoneal and overlying the aorta which was thought to be metastatic glands. This mass was so extensive that it pushed the cardiac part of the stomach far over to the left. An infiltrating mass was felt invading the stomach from the lesser curvature just beneath the diaphragm. Many nodes along the greater and the lesser curvatures were enlarged, but seemed soft and did not suggest malignancy. The condition, however was believed to be carcinoma, primary in the stomach with metastases to the regional lymph-glands. It was obviously hopeless and the abdomen was rapidly closed. The pulse was rapid throughout and the patient was in poor condition at the end of the operation.

*Postoperative Course*—The patient regained consciousness, but remained in a critical condition. He suffered from persistent hiccups his pulse was rapid and thready and a few hours after operation became absolutely irregular with a large pulse deficit. It grew steadily worse and died eight hours after operation.

*Case II.*—W H W P B B H No 29,321 The patient, a married American man of fifty-seven employed as a painter was admitted to the hospital May 21 1921 with the complaint of abdominal pain. The family history and the marital history were negative. There was nothing of importance in the past history there were no gastro-intestinal symptoms before the present illness and no history of venereal disease. The patient had been accustomed to drink whisky "freely" up to two years before admission.

*Present Illness*—For ten months before entrance the patient had been having a dull epigastric pain of varying severity which came on about half-hour after meals. The severity and dura-

tion had been increasing and for five weeks before entrance he had been in "continuous agony." The pain had been slightly relieved at times by soda but food especially meats, had aggravated it. His diet for some weeks had consisted largely of crackers, toast, eggs, and milk. There had been no nausea or



Fig. 442.—Radiogram of stomach, Case II May 11, 1921 before operation. There is definite annular constriction in the region of the antrum which persisted throughout the fluoroscopic examination. Liquids passed this constriction as this stream.

vomiting and no bloody or tarry stools. The patient had never been jaundiced. A year before admission he weighed 155 pounds and on admission 117 pounds.

Physical examination showed a much undernourished man. There was slight tenderness in the epigastrium, but no mass could



be felt. There were no enlarged lymph-glands and the rectal examination was negative. Nothing else of importance was found in the physical examination.

The urine was negative the hemoglobin 65 per cent. (Tajqvist) the red blood-cell count, 3 740,000 the white count, 7500. The blood Wassermann was negative. Gastric analysis showed an absence of free hydrochloric acid and a low total acidity. Ray examination (Fig. 442) of the stomach showed a definite annular constriction in the antrum which persisted throughout the fluoroscopic examination and was shown also in the plates. The lumen at this point was small, but there was no obstruction to liquids. This defect was interpreted as representing an annular neoplasm of the stomach.

On the basis of the history and these findings a diagnosis of carcinoma of the stomach was made and operation was advised.

Operation (May 23 1921) A midline epigastric incision was made. The stomach appeared normal on inspection, but palpation revealed in the lumen of the stomach extending proximally  $2\frac{1}{2}$  inches from the pylorus a hard irregular mass which constricted the lumen so that it hardly admitted the tip of the finger. There were enlarged glands on both the greater and lesser curvatures. The condition was thought to be incurable cancer but a resection was decided on in the hope that it would give greater relief than simple gastro-enterostomy. The duodenum was freed from its posterior attachments at a point 1 inch below the pylorus, clamped and divided and the distal stump cauterized. The vessels in the greater and lesser curvatures from this point upward for about  $3\frac{1}{2}$  inches were then ligated with fine silk and divided at some distance from the stomach so as to remove the glands with the specimen. At a point  $3\frac{1}{2}$  to 4 inches above the pylorus the stomach was clamped and divided and the proximal stump cauterized. The two stumps were closed with running sutures of No. 1 chromic catgut and second row of silk mattress sutures. The section of stomach removed was opened, and both incisions were found to be well outside the growth. The cut edge of the gastrotomic omentum was then sutured to the lesser omentum. The posterior wall of the stom-

ach was then drawn through a rent in the transverse mesocolon and a posterior gastro-enterostomy performed with two layers of continuous fine silk sutures at a point about  $1\frac{1}{2}$  inches above the limit of the resection. A small drain was led to the duodenal



Fig. 413.—Radiograph of stomach, Case 11, April 23, 1922, eleven months after operation. Stomach small, high under left costal margin, stomach functioning well, operative defect smoothly outlined in region of the media.

stump and the abdomen closed. The patient stood the long operation well and was returned to the ward in good condition.

*Postoperative Course.*—The patient's immediate convalescence was complicated by a bronchopneumonia, the signs of which

appeared on the second day. The physical signs of a consolidation in the right lower lobe were confirmed by x ray. Temperature became normal on the sixth day and from then on convalescence was uneventful. On the twenty fourth day he was discharged. The wound was completely healed the patient was



Fig. 444.—Radiogram chest, Case II April 23, 1922, eleven months after operation. No evidence of metastases.

feeling well and was taking five meals a day consisting of a fairly liberal diet, with no gastric symptoms. x Ray studies made June 15 1921 just previous to discharge showed the stoma functioning well.

This patient was seen again seven months later. He appeared spare but seemed active and well. Weight in street clothes,

without overcoat, 133 pounds. Examination of the abdomen revealed no abnormal masses or tenderness. The liver was found to be 2 inches below the costal edge in the nipple line, firm and regular. Some enlargement of axillary lymph-nodes. Other wise nothing. The patient stated that he felt very well and hadn't missed a day's work in six months. No gastric complaints.

He was last seen May 1, 1922, almost twelve months since the first admission. The general condition was as above and there were no complaints. x Ray studies (Fig. 443) made April 23, 1922, revealed a small stomach high under the left costal margin. The stomach functioned nicely and the operative defect was seen rather smoothly outlined in the media of the stomach. A chest plate (Fig. 444) showed no evidence of pulmonary metastasis or disease.

#### PATHOLOGIC STUDIES

Case I.—P. B. B. H. Autopsy A-21-27. *Gross Description*—Body that of well-developed and slightly emaciated male. No superficial edema. Abdominal wound.

Pleural cavities. No fluid, a few apical adhesions. Grayish tumor nodules on posterior surface of sternum and at attachment of pericardium to diaphragm. Heart and lungs normal.

Abdominal cavity. Filled with about 200 c.c. of thick, pale reddish fluid. Smear shows staphylococci and leukocytes. Stomach pushed forward by a large tumor mass located near its fundal portion and extending behind it to the pancreas. No general enlargement of mesenteric lymph-nodes.

Liver, kidneys, adrenals, bladder, prostate and spleen normal. Pancreas appears normal, but is adherent to the tumor mass.

The large tumor mass was removed as a whole in connection with the stomach, duodenum, pancreas, aorta, and cava. After its removal it was seen that the disease, which seemed primary in the stomach, had extended upward and downward in the postpleural and postperitoneal lymphatic channels.

On opening the stomach it was seen that the tumor filled the walls about the cardia, especially in the posterior aspect, making

them thick and non-elastic and raising the mucosa like a plateau (Figs. 445-446). There were no macroscopic ulcerations. Behind the stomach the tumor spreads out into smooth rounded matted masses gradually diminishing in size as they get away from the vicinity of the stomach. The largest mass however lying against and in the posterior wall of the fundus is the size of an orange with multiple irregular extensions.

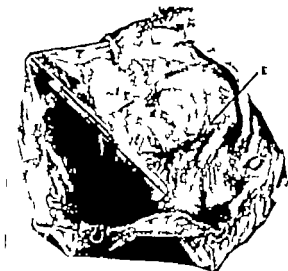


Fig. 445.—Gross specimen stomach, Case I. E, Esophageal opening into stomach; notice firm indurated appearance without gross alteration of entire area about cardiac orifice.

*Histologic Study*—Stomach. There are two sections from the edge of the tumor so as to include about  $1\frac{1}{2}$  cm. of relatively normal wall. The gastric mucosa is intact and stains well except over the place where the tumor is of greatest thickness. The tumor is very cellular and can be seen to begin as an infiltration of the submucosa, then spreading through the muscularis mucosae separating the muscle-fibers (Fig. 447). It has proceeded into the internal circular muscle but the greatest growth is in the submucosa and mucosa, the tumor projecting into the stomach cavity.



Fig. 416.—Gross section through specimen from Case 1 at level of esophagus. C Cardiac orifice note constriction at orifice but encircling tumor growth, large mass posterior to opening and the great thickening of stomach-wall here infiltration has occurred.



Fig. 417.—Case 1. Low power microphotograph through stomach-wall at edge of tumor showing massive infiltration of tumor and submucosa with disruption of muscular layers and extension to serosa.

but not causing much irregularity of the serous side in the sections. The cells comprising the tumor are strikingly like the large round cells of lymphoid tissue. They show variation in size and shape but they average in size that of the large lymphocyte and in shape are polyhedral or ovoid. The nucleus occupies most of the cell usually but a scant rim of basic staining cytoplasm being present. The nucleus has a fairly large densely staining nucle-

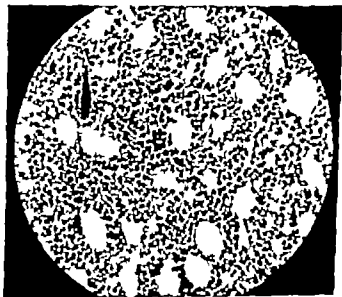


Fig. 448.—Case I. Microphotograph through section of ovary in the subserosal fat layer showing cellular infiltrating nature of growth and breach of stroma.

olus, from which chromatin filaments radiate to the periphery. Many smaller cells are scattered promiscuously throughout which closely resemble small lymphocytes. Mitotic figures are numerous in both the large and small cells. A moderate number of eosinophils are scattered through the tumor. There is very little stroma in the more cellular parts of the tumor and thin-walled blood vessels are present in but small numbers, and in

some of these tumor cells are present. Invasion of lymphatics is seen. A few necroses are seen but they are probably post mortem. This tumor falls under the group of lymphosarcoma derived probably from the lymphatic cells typically seen in the germinal centers of any lymph-follicle (Figs. 448-449)

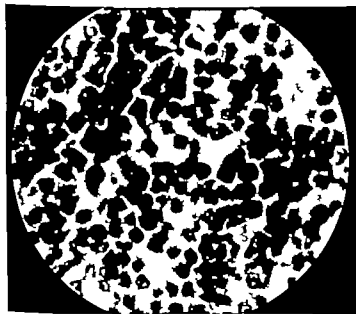


Fig. 449—Case 1. Oil immersion photomicrograph, showing numerous mitotic figures and general characteristics of type of cell. Little variation in size of cells, large nuclei, usual ovoid shape, and small amount of protoplasm.

**Pancreas.** A section shows a lymph vessel in one of the septa partially filled with cells which closely resemble the cells of the stomach tumor. The parenchyma is normal.

**Lymph-nodes.** Three sections show complete replacement of lymphoid structure by tumor and invasion of the capsule and surrounding fat has occurred.

**Adrenal.** One section is negative. Another shows a small collection of tumor cells just outside the capsule at one point. No tumor is present in the adrenal proper.



**Kidney:** Two sections show moderate senile changes, sclerosis of arterioles, atrophy of convoluted tubules, and fibrosis of glomeruli in small groups only, most of the parenchyma being essentially normal.

**Prostate:** A section shows atrophy and fibrosis of smooth muscle and arteriosclerosis. A rare corpus amyloaceum is seen. Otherwise it is negative.



Fig. 430.—Case II. Low power microphotograph taken edge of tumor, note replacement of stroma and infiltration of subserosa by tumor.

**Summary:**—The tumor in the stomach is what is usually called a lymphosarcoma. It has metastasized to the pancreas, regional and retroperitoneal lymph-glands, and fat. The other organs show slight lesions, chiefly those usually associated with senility.

**Case II.—P. B. B. H. 5-21-337. Gross Description.**  
Specimen consists of a portion of the stomach measuring roughly 8½ cm. x 11 x 1 cm. thick. Specimen was laid open. The mucosa is irregularly injected and presents three areas of cicatrization. This cicatrization extends over an area 4 cm. in diameter, being redder than elsewhere and irregularly studded with firm, gray

elevations, particularly around the contracted center. Adjacent to one of these areas is a small ulcerated area 1 x 1.2 cm. The serous surface is smooth and gray and has attached in linear arrangement small shaggy red tissue apparently omental adhesions. On section it is found that the mucosa is definitely thickened and uniformly gray throughout. A few attached lymph-nodes appear slightly enlarged gray and firm.

*Microscopic Report.*—Two sections show a tumor growth which has replaced the mucosa and submucosa as far as the muscular layer (Fig. 450). It is composed of cells which vary a great deal in size and shape. In many the nucleus occupies most of the cell and has 1 to 3 deeply staining nucleoli and a dense chromatin network. Others are larger have prominent nucleoli, and a faint bluish chromatin network. Mitotic figures are numerous in the larger cells. Along the mucosa an exudate is seen. Endothelial leukocytes and a few eosinophils are also seen. This appears to be a tumor arising from the lymphoid tissue of the mucosa, the cells being in equal proportion, small lymphocytes and large lymphocytes of the type seen in the germinal centers of lymph-follicles (Figs. 451-452).

*Diagnosis.* Lymphosarcoma of stomach.

*Summary.*—Two cases of lymphoblastoma of the stomach are presented. Both patients were males, fifty-seven and fifty-nine years of age respectively. Both cases were diagnosed as carcinoma before and at operation, although the findings at operation were not typical of cancer. One case is still living and apparently well twelve months following partial gastrectomy. The other case proved inoperable and died eight hours after operation.

No findings were made which seen even in retrospect aid in the differential diagnosis from cancer. Both individuals showed loss of weight, cachexia, anorexia, absence of free hydrochloric acid, and lesions demonstrable by the x-ray similar to cancer. In one case there was a palpable tumor. The symptoms had been present from seven to ten months.

The tumors in both cases are strikingly similar histologically and yet show a wide variation in clinical malignancy. Both

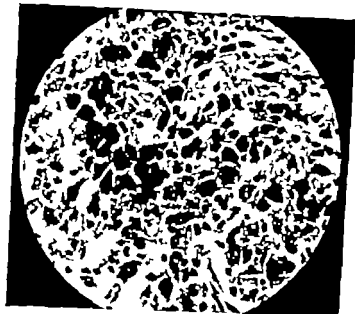


Fig. 451

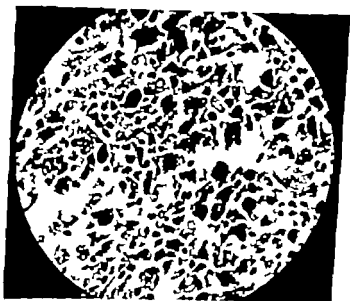


Fig. 452

Figs. 451, 452—Case II. Oil immersion microphotographs, showing type of cell, mitoses, and infiltrating nature of growth. Coccyne 14

appear to have had their origin in the submucosa. In one case the tumor rapidly spread beyond the confines of the stomach although no reason why the other failed to do so can be found. The only physical variation lay in the anatomic seat of the lesion, which in the favorable case was the pylorus. Time however may vitiate the present conception of a cure in this case.

We wish to express our thanks to Prof S. B. Woolbach for assistance and advice in the preparation of the photomicrographs.

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## CONTRIBUTION BY DR. DANIEL FISKE JONES

MASSACHUSETTS GENERAL HOSPITAL

### ACUTE PANCREATITIS

ACUTE pancreatitis," the title of this paper is not a good term as the condition to which we wish to call your attention is definitely a necrosis of the parenchyma followed by hemorrhage into the pancreas and surrounding tissue. Acute pancreatic necrosis" describes more accurately the condition which is the subject of this paper and will be used in the place of acute pancreatitis.

Experimental work has been going on at intervals since Claude Bernard first produced acute pancreatic necrosis in 1856 by the injection of bile and sweet oil into the pancreatic duct. Since then the condition has been produced experimentally by the injection of various substances into the pancreatic duct, including normal bile during digestion infected bile bile rich in bile salts, and duodenal contents.

Ople's work on pancreatitis contained many significant facts which have apparently been overlooked. It had long been noted that acute hemorrhagic pancreatitis was frequently associated with gall-stones and in 1901 Ople reported a case in which a gall-stone was found impacted at the papilla of Vater in such a way that the stone blocked the common duct, but did not block the pancreatic duct. The two systems were in this way made into one and Ople believed that the pancreatitis was due to the regurgitation of bile into the pancreatic duct. It was soon demonstrated however that gall-stones were present in not more than 50 per cent. of the cases of pancreatic necrosis. Ople also demonstrated that the arrangement of the common and pancreatic ducts was such that a stone at the papilla could block the common duct, yet leave the pancreatic duct open in only a small proportion of cases. This has been used as an argument against the theory of regurgitation of bile as the

cause of pancreatic necrosis but when we consider the small number of cases of acute hemorrhagic necrosis reported (42 in twenty years at the Massachusetts General Hospital) the proper arrangement of ducts occurs with more than sufficient frequency to permit this number of cases.

Besides Opie's experiments and report of the autopsy given above, he reported in his book 4 autopsies which deserve much more serious consideration than has been given to them, for there are few autopsy reports that have gone into details as to the relation of the necrosis of the pancreas to the pancreatic ducts and the anatomic relation of the bile and pancreatic ducts to each other. These 4 autopsies which give us these details must, therefore be considered carefully. The first is the autopsy report of a case by Elliot, a patient who after long-continued vomiting, had a severe attack of epigastric pain and died in three days. At autopsy an acute hemorrhagic necrosis of the pancreas was found. The duct of Wirsung was very small and the duct of Santorini, with a normal opening into the duodenum was the main duct of the organ. The necrosis was localized almost entirely about the duct of Santorini.

The second case, that of Bassett, was an acute hemorrhagic necrosis which was localized about the duct of Santorini, which drained only a small part of the head of the gland and was patent throughout its course into the duodenum.

Two other cases—those of Johnston—were acute hemorrhagic necrosis, in which the duct of Santorini was the main duct of the organ, with a normal opening into the duodenum.

There are several facts to be considered in connection with these cases. Brocq and others have shown experimentally that duodenal contents injected into the pancreatic duct will produce hemorrhagic necrosis. In all 4 of these cases the main duct of the pancreas, or the one about which the necrosis was localized was the duct of Santorini. In 2 the necrosis was definitely limited to the area drained by the duct of Santorini in 1 a very small area and in the other a large part of the gland.

It would seem from the consideration of these reports that we must consider not only retrojection of biliary and

normal bile during the process of digestion into the pancreatic duct but also retrojection of duodenal contents into the duct of Santorini, as causes of acute pancreatic necrosis.

Archibald,<sup>2</sup> appreciating that gall-stones were not always present to block the outflow of bile in the cases of pancreatic necrosis started investigations, and found a sphincter muscle at the duodenal papilla, and later found that this sphincter had been described by an Italian physiologist named Oddi. He then determined to inject various substances under a pressure which the sphincter of Oddi would resist, that is, a pressure of from 400 to 700 mm. of water. Infected ox-bile, injected under a pressure of 500 mm. of water produced excessive hemorrhagic necrosis. Sterilized human bile produced slight necrosis of the parenchymal cells detected only by the microscope. Sterilized human bile, deprived of its mucin, produced a much more extensive necrosis. These experiments demonstrated that a pressure considerably greater than that at which bile would be excreted, that is, 350 mm. of water was necessary to produce an effect upon the pancreas. No physiologic means of increasing the pressure in the biliary system was found.

Judd and Mann took up these experiments at this point, and demonstrated that even though the gall-bladder is a muscular organ, contraction of it will not increase the pressure in the biliary system more than 50 mm. of bile. They also demonstrated that by causing the violent muscular effort of retching the pressure in the biliary system could be increased to 500 and 1000 mm. of bile. They then injected normal bile from the animal operated upon into the biliary system at pressures of 500 and 1000 mm. of bile. The effect was so slight under both pressures that they considered that bile injected into the pancreatic duct under physiologic conditions had no effect upon the pancreas.

In the light of Archibald's and Brocq's experiments there are several points to be considered in these statements of Judd and Mann. Archibald stated that normal sterile bile produced no macroscopic changes but that microscopically there was some necrosis when introduced under the conditions used by Judd



and Mann. Judd and Mann did not give us the microscopic findings.

Brocq states that normal bile injected into the pancreatic duct will produce hemorrhagic necrosis only if injected during the process of digestion. Archibald also demonstrated that changed bile—that is, either infected bile or bile deprived of its mucin or bile rich in salts would produce much more extensive necrosis than normal sterile bile.

If we now combine the experiments of Archibald, Brocq and Judd and Mann we have all the steps necessary to produce pancreatic necrosis under physiologic conditions. That is, Archibald has demonstrated that the sphincter of Oddi will resist a pressure of from 400 to 600 mm. of water and that infected bile or bile with little mucin or an increased proportion of bile salts, introduced into the pancreatic duct under that pressure, will cause pancreatic necrosis. It is fair to assume that in cases of pancreatic necrosis we have an infected or changed bile. Even if we do not have an infected or changed bile, Brocq has demonstrated that normal bile introduced into the pancreatic duct during active digestion will produce necrosis. Many cases of pancreatic necrosis in humans occur soon after a hearty meal. Judd and Mann furnish the one missing link by demonstrating that the pressure in the biliary system can be increased to 1000 mm. of bile by violent muscular effort, such as retching.

Judd and Mann reject Archibald's theory, as to the cause of pancreatitis partly because of the slight effect of normal bile on the pancreas, as stated above and partly because the proper anatomic relation of the ducts occurs so seldom. That is the anatomic arrangement of the duct of Wirsung and common duct must be such that a spasm of the sphincter of Oddi or a small stone at the papilla can close the common duct without closing the duct of Wirsung at the same time. Observations made by Judd and Mann on 170 autopsies demonstrated this to be possible in only 9 out of 200 individuals. Opler examined 100 cases at autopsy and found that the arrangement of the ducts was such that it could occur in 30 out of 100. Deaver and Sweet<sup>4</sup> also use this as an argument against Archibald's theory.

but if we consider the number of cases of pancreatitis of what ever variety we would quite certainly not have more than 9 cases in each 200 individuals. If we accept the clinical evidence as given us in Opie's 4 autopsy reports, that retrojection of the duodenal contents may cause pancreatic necrosis, the anatomic arrangement of the ducts would be such as to permit the occurrence in 10 out of each 100 individuals (Opie) that is, the duct of Santorini is the main duct in that proportion of individuals. It would seem, therefore, that we have sufficient experimental and clinical proof and the proper anatomic relation of the ducts in a sufficient number of individuals to warrant us in saying that the retrojection of bile or duodenal contents into the pancreatic ducts may cause pancreatic necrosis.

Deaver and Sweet and Judd and Mann have accepted Vaugueret's theory that pancreatitis is caused by an infection of the pancreas from the gall-bladder through the lymphatics of the gall-bladder to the lymph-nodes of the cystic duct thence by periductal lymphatics through the glands along the common duct to the glands at the head and margin of the pancreas, thence by regional lymphatic distribution in the head of the pancreas.

Archibald is opposed to this theory on the ground that it is difficult for an infection to pass from the gall-bladder to the pancreas against the lymphatic current and through so many sets of glands.

Graham and others have however seemed to prove that it is quite possible for infection to pass in this way. One objection which we have to this theory is that there is no experimental proof that an acute hemorrhagic necrosis can be caused by infection through the lymphatics. Graham shows bacteria in the interstitial tissue of the pancreas but says nothing about pancreatic necrosis.

It is very unsatisfactory to leave the solution of the problem of the etiology of acute pancreatitis here but it seems impossible to go farther unless we are willing to concede that acute pancreatic necrosis, and pancreatitis so often found in association with infections of the biliary system are two distinct diseases with different causes.

It is difficult to discuss a subject when so little is known about the pathologic findings as we know about those of pancreatitis associated with infections of the biliary system. In fact, some pathologists go so far as to say there is no such condition as the chronic pancreatitis which surgeons find so often associated with gall-stones. So far as we can learn the pancreatitis associated with infections of the biliary system is an inflammatory change in the interstitial tissue of the gland, and is so spoken of by Ople. Graham has also shown bacteria in the interstitial tissue of the gland in certain cases of experimental cholecystitis. On the other hand the condition found in the pancreas in acute pancreatic necrosis is primarily a necrosis of the parenchymal cells, and in certain cases at least the necrosis is localized along the pancreatic duct involved as demonstrated by Ople.

Is it not possible therefore that we are dealing with two distinct diseases due to different causes?

*It is impossible to read the articles of Deaver and others who accept Mangeret's theory as to the cause of pancreatitis, and those of Archibald and others who believe in Ople's theory without feeling that they are discussing two different diseases.*

Archibald and others produce pancreatic necrosis experimentally almost at will by the injection of bile and duodenal contents into the pancreatic ducts under physiologic conditions, while those who consider that pancreatitis is due to an infection report no experimental cases of acute hemorrhagic necrosis due to lymphatic infection. Graham shows bacteria in the interstitial tissue of the pancreas, yet says nothing of pancreatic necrosis. Deaver and Sweet state that pancreatitis is a lymphatic infection of the gland and Graham shows the bacteria present in the interstitial tissue but no bacteria are found by smear or culture in the cases of pancreatic necrosis. Deaver states that in pancreatitis the gall-bladder or ducts show an infection in 91 per cent. while in pancreatic necrosis it would be difficult to state with accuracy that they were infected in 50 per cent of the cases.

If pancreatic necrosis is due to the same cause as the pan-

creatitis found in conjunction with cholecystitis, is it not rather extraordinary that so few cases of pancreatic necrosis occur? Pancreatitis has been found to be present in from 23.8 to 50 per cent. of the cases of cholelithiasis. Among such a large number should we not expect more cases of pancreatic necrosis? We have been able to find but 42 cases in the records of the Massachusetts General Hospital and gall-stones were present in but 50 per cent. of those.

In pancreatitis of the interstitial type the tendency is to recover no matter what operation is done while in pancreatic necrosis death occurs in at least 70 per cent. of the cases.

To sum up the preceding it is my belief that the pancreatitis associated with infections of the biliary tract is an inflammation of the interstitial tissue due to an infection frequently through the lymphatics of the biliary systems that acute pancreatic necrosis is a necrosis of the parenchymal cells due to a retrojection of bile into the duct of Wirsung or to a retrojection of duodenal contents into the duct of Santorini.

The interstitial pancreatitis may be acute or chronic while the cases of pancreatic necrosis are always acute. There are undoubtable cases of recurrent pancreatic necrosis in which only a small area of the gland is involved. This is an aseptic necrosis and is absorbed, leaving little or no evidence of it later. This has been demonstrated experimentally by Whipple.

It is also interesting to note that in 43 cases of acute pancreatic necrosis, 22 occurred in patients without gall-stones, and of these 17 had had one or more previous attacks of epigastric pain.

In considering the cases of pancreatic necrosis in this report I have included only those cases which showed definite macroscopic evidence of pancreatic involvement the great majority of these were cases of acute hemorrhagic necrosis of the pancreas. Acute abscess of the pancreas has been included because it is impossible to separate them from hemorrhagic necrosis which has broken down. The total number of cases is 56 42 of which were found in the Massachusetts General Hospital records, while 14 were private cases.

As to symptomatology there is nothing unusual. The pain is a sudden severe epigastric pain. The patient at once goes into shock of greater or less severity depending upon the extent of the lesion.

The pain, after the first severe attack, becomes a great distress, not only in the epigastrium but frequently in the back. Patients will frequently say the pain is not severe but the distress is almost unbearable. They move about in bed and impress one as being in great distress. The pulse is rapid, ranging from 100 to 160 often too rapid and small to count. The temperature subnormal during the first few hours gradually rises to 100° F rarely more. The patient is cyanotic varying with the severity of the condition. Nausea and vomiting are usually persistent. There is leukocytosis, varying between normal and 15,000.

The abdomen contains bloody fluid and is everywhere slightly tender all over with definite tenderness over the pancreas, starting in the region of the gall-bladder and extending across the abdomen a varying distance, depending upon the extent of the involvement of the pancreas. This tenderness is always present in the first few days if carefully looked for but may not be so evident after the acute stage passes. The careful localization of this tenderness is frequently the only means of making a differential diagnosis between an acute cholecystitis and a pancreatitis. Two cases have recently been reported by a surgeon, who stated that there was no abdominal tenderness in either case. If this were true after a painstaking examination of the whole abdomen, they would be almost unique cases.

The definite localization of tenderness extending to the left from the gall-bladder region, or at times definitely more marked to the left of the spine is often the only means of making differential diagnosis between a pancreatitis and lesion of some other organ in the upper abdomen. It is so important that my resident has recently made a correct diagnosis in 2 cases in which no other surgeon who had seen the patient had made a diagnosis.

Another important physical sign when present is tenderness at the left costovertebral angle due to involvement of the tail

of the pancreas. Obstipation is a symptom which is always present early and associated with the pain and nausea as it usually is, makes the diagnosis of intestinal obstruction a frequent one. In fact, among 42 cases a cecostomy was done once and an ileostomy twice. The various tests, such as Cammidge's have proved of little value.

As to treatment, we must be guided by what we believe to be the etiology of the type of disease we have to treat. If we accept Maugeret's theory we must remove the gall-bladder the source of the infection. If we accept Graham's experiments which demonstrate the infection of the gall bladder from a hepatitis through the lymphatics we must, I think, admit the lymphatics of the hepatic and common ducts may become infected from the liver and the pancreas infected through them. If this is a fact, removal of the gall bladder would be of little value. However removal of the gall-bladder is the only rational treatment under the circumstances, as we can do no more. If we accept Archibald's theory that acute pancreatitis is due to retrojection of bile into the pancreatic duct because of obstruction at the papilla of Vater either by a spasm or a stone some thing must be done to relieve the pressure in the ducts, that is a cholecystostomy or a choledochostomy is the rational operation. Archibald suggests drainage from three weeks to several months, or section of the sphincter of Oddi at the papilla, which at once reduces the possible pressure in the ducts to 60 or 70 mm. of water. Drainage of the biliary system for three weeks appears to be rational as it gives the pancreas an opportunity to return to normal and permits any temporary condition which may have caused a spasm of the sphincter of Oddi to subside but it is difficult to see what advantage longer drainage can be. It is not likely that drainage for a longer time can make a permanent change in any condition which has caused the spasm of the sphincter of Oddi. If there is hyperacidity which has caused the spasm the only rational treatment is section of the sphincter suggested by Archibald and treatment of the hyperacidity. But we are discussing the treatment of acute pancreatitis, and in the case of acute hemorrhagic necrosis of the pancreas the

condition of the patient does not often permit any prolonged operative procedure. In such cases the simplest method of drainage of the biliary system should be carried out, that is, cholecystostomy.

Archibald advises against any drainage of the capsule of the pancreas. He says that the shock associated with the disease is due to the products of digestion, and drainage would be of no value. We are opposed to this theory on the ground that many of these patients improve at once after drainage of the fatty capsule of the pancreas or of the pancreas itself.

If we believe that retrojection of duodenal contents into the duct of Santorini may cause pancreatitis we have no method of drainage of the duct that will be effective—we must, therefore, depend upon drainage of the fatty capsule of the pancreas or the pancreas itself.

Pierre Delbet<sup>28</sup> suggests section of the common duct and a union of the gall-bladder with the small intestine. This would obviate any possibility of retrojection of bile into the pancreatic duct, but it is a procedure which very few of the cases of acute pancreatic necrosis could withstand.

The results of the various methods employed in 56 cases of acute pancreatic necrosis, collected from the records of the Massachusetts General Hospital and my own records are as follows:

Total number of cases	56
Total mortality (per cent.)	60.7
Mortality of pancreatic necrosis without the cases of abscess (per cent.)	72.3

Operation	Total No.	Surv.	Md.	Deaths	Mortality per cent.
No operation	6	6	0	6	100
No drainage or drainage of abdominal cavity	14	10	4	12	86
Drainage of pancreas including abscesses	29	25	4	8	28
Drainage of pancreas without abscess	20	18	2	11	55
Drainage of abscess alone	9	7	2	0	00
Drainage of biliary system	3	2	1	2	66
Drainage of biliary system and pancreas	3	2	1	3	100

There are 6 cases in which the biliary system was drained in 3 the fatty capsule of the pancreas was also drained. The mortality of the group was 83 per cent. There were 20 cases of acute hemorrhagic necrosis of the pancreas in which the pancreas or fatty capsule of the pancreas was drained without any other procedure and the mortality was 55 per cent.

While this group of cases is small it seems to give some indication as to what should be done, and indicates that drainage of the fatty capsule of the pancreas or the pancreas gives better results than any other procedure. Drainage of the gall-bladder or better still the common duct, if the condition of the patient will permit, may be and at least theoretically would be a valuable addition to drainage of the fatty capsule of the pancreas or pancreas itself.

Archibald advises waiting on these patients until they have recovered from the shock, as he feels it is due to the absorption of split proteins and operation will do no good. While this may be correct theoretically we are convinced after operating upon a number of these cases that operation the moment the patient's condition will permit with novocain and gas oxygen anesthesia will give far better results than waiting. The ideal operation would be drainage of the common duct drainage of the fatty capsule of the pancreas and pancreas itself. If the common duct cannot be drained easily a cholecystostomy should be done instead and if only little can be done drainage of the fatty capsule of the pancreas alone should be done.

Since writing the foregoing part of this paper a group of 4 cases have come into the Massachusetts General Hospital, and I have had one in my private practice all of which overlapped one another in time in the hospital. These 5 cases make quite an unusual group varying in severity from moderate to very severe. There is a predominance of gall-stones associated with the disease of 4 to 1. One case is a duplicate of Ople's classical case of a stone impacted at the papilla. The history and conalescence is typical of this group of cases. The operation in all was what I believe should be the routine operation when conditions permit. The mortality was unusually low—20 per cent.



Case I.—J F M Male aged thirty February 15 1922

*Preoperative Diagnosis*—(1) Intestinal obstruction. (2) Acute abdominal infection. (3) Perforation of viscus. (4) Acute pancreatic necrosis.

*History*—Two days before entrance *after a hearty meal* he developed *great discomfort in the abdomen*, with a marked sensation of pressure. A "choking sensation" which became so pronounced he thought he would die. Has vomited frequently. Bowels have not moved for two days.

*Physical Examination*—A rather obese young man. No visible peristalsis. Flat in both flanks. *Definite tenderness across abdomen above the umbilicus*. Temperature 100.6° F Pulse 110. White blood-cells 24,000.

*Following Day*—Great distress all over abdomen. Unable to remain quiet. Marked tenderness across abdomen between umbilicus and ensiform.

*Operation* (February 16th)—Blood-tinged fluid in abdomen. Areas of fat necrosis everywhere. *No gall stones*. Pancreas exposed through gastrohepatic omentum. Whole pancreas very dark and firm, with a large dark, softened area in the head. Pancreatic capsule and the softened area opened with finger and drained with three cigarette wicks.

Temperature normal pulse 80 and great distress gone almost immediately following operation.

Convalescence uneventful and patient left the hospital well in four weeks.

Case II.—E. R. Male aged forty March 8 1922.

*Preoperative Diagnosis*—(1) Cholelithiasis and subacute cholecystitis. (2) Acute pancreatic necrosis.

*History*—Acute attack of epigastric pain four years ago since when numerous attacks of pain associated with jaundice once. Constant pain in epigastrium for ten days. Nausea and vomiting. Bowels have not moved for two days.

March 9th An attack of severe epigastric pain.

March 13th Another severe attack of epigastric pain.

Sclera slightly yellow.

*Physical Examination*—An obese man. Abdomen soft except from midline to costal border on the right.

White blood-cells 10,200

Fat present in stools two days.

Bile present in urine.

x Ray consistent with gall-bladder disease.

*Operation* (March 14 1922)—Gall bladder thickened and contained stones. Dark bloody fluid in the abdomen. Pancreas dark red and necrotic in areas. Pancreatic capsule and necrotic areas drained through the gastrohepatic omentum with two cigarette wicks.

*Cholecystostomy*—Temperature normal until twelve days after operation when he began to run an irregular temperature between 99° and 101° F and broken down material began to discharge from the wound. The temperature continued for two weeks, then came down to normal. The patient left the hospital at the end of four weeks with a discharging sinus.

*Case III.*—W B A Male aged forty nine. March 26 1922.

*Preoperative Diagnosis*—(1) Cholelithiasis and acute cholecystitis. (2) Acute pancreatic necrosis

*History*—First attack of epigastric pain seven years ago accompanied by jaundice. Attacks at irregular intervals since. Yesterday at 11 A. M. had epigastric pain, severe no temperature, pulse normal. Twenty four hours later pain became constant and hard to bear

*Physical Examination*—A fat man. Abdomen soft except above the umbilicus. Definite tenderness extending from the gall-bladder region across the abdomen to the left of the spine. Sclera slightly yellow temperature 100° F pulse 110

March 29th Patient has been increasingly uncomfortable marked tenderness above the umbilicus extending to the left of the spine temperature 101° F pulse 115

*Operation* (March 29th)—Gall-bladder contained stones, but did not give any evidence of infection. At the base of the mesocolon and in the omentum areas of fat necrosis. Lesser peritoneal cavity contained blood. The left half of the pan-

grew was surrounded by a mass of blood and there was a large necrotic area in the pancreas. Pancreas drained through gastrohepatic omentum by two cigarette wicks. Cholecystectomy and choledochostomy. Patient much relieved immediately. Convalescence normal for eleven days when he began to run a temperature between 99° and 101° F., which continued for two weeks. During this time there was a free discharge of necrotic fat and what appeared to be pancreatic tissue. Patient went home at the end of four weeks with a discharging sinus, which is still (June 15 1922) discharging a cloudy fluid.

Case IV—*Ida G.* Female, aged thirty-eight. April 5 1922

*Preoperative Diagnosis*—(1) Acute appendicitis. (2) Perforated viscus. (3) Acute cholecystitis.

*History*—Shortly after evening meal a sudden pain in back and right lumbar region. Soon all over abdomen. Severity has gradually increased. Vomited yesterday constant nausea. Bowels have not moved for three days.

*Physical Examination*—Fat woman, lying in bed with knees drawn up. In great distress. Dulness in flanks. General abdominal tenderness, especially marked in midline and to the right above umbilicus. No mass. Temperature 102° F pulse 110. White blood-cells 10,000.

*Operation* (April 5 1922)—Free blood-tinged fluid in abdomen areas of fat necrosis, especially in gastrocolic omentum. Several large hemorrhagic areas and areas of necrosis in the pancreas. Necrotic areas punctured and the pancreas drained with cigarette wicks.

Gall-bladder thickened and contained bile and pus. Cholecystostomy. Temperature came gradually to normal eleven days after operation pulse 90. On fifteenth day temperature rose to 103° F and continued between 100° and 102° F until fifty days after operation, when it dropped to 100° F at its maximum where it remained until her discharge sixty two days after operation. From the fifteenth day until her discharge there was discharge of thin pus and necrotic material.

There was fat in the stools on four different days late in the course of the disease.

Patient returned to hospital in June still running a temperature. A cavity containing thin pus and necrotic tissue was drained at this time.

Case V—W McD March 24 1922

*Preoperative Diagnosis*—(1) Perforated gastric ulcer (2) Ruptured gall-bladder (3) Acute pancreatic necrosis.

*History*—Attacks of indigestion for four years of one day's duration or less. Hearty meal would cause distress, nausea and vomiting. Six days ago in evening shortly after a hearty meal, a sudden severe pain in epigastrium followed by nausea and vomiting. Pain has persisted but has been much worse in last forty-eight hours last two days over whole abdomen, constant and severe in the upper half. Vomiting has persisted. Bowels constipated. Tenderness throughout abdomen. Patient up and about until forty-eight hours ago.

*Physical Examination*—A fat woman, cold pulseless, marked pallor. Evidently extremely sick. Mentally alert. Abdomen full and rounded. Tense throughout, but more marked in upper half and more to right of median line. Pain localized by patient across epigastrium. Remained pulseless and died in four hours.

*Autopsy*—Abdomen filled with a bloody fluid. Areas of fat necrosis. The pancreas was surrounded by a large quantity of blood and the body was necrotic. The papilla of Vater was closed by a small stone which left the duct of Wirsung free. The pancreatic duct and the pancreas were deeply stained with bile.

It is of interest to consider these 5 cases as a group to see what facts we can get out of them that have a bearing on acute pancreatic necrosis.

I. As to Etiology—In all but one gall-stones were present. In one a small stone was lodged at the papilla, leaving the duct of Wirsung open into the common duct that is a condition similar to that in Opie's classical case existed. In the other 3 gall-stones were present but there was no evidence of a stone in the common duct, and it is probable that the stones played no direct part in the causation of the condition. In 1 there was

crem was surrounded by a mass of blood and there was a large necrotic area in the pancreas. Pancreas drained through gastrohepatic omentum by two cigarette wicks. Cholecystectomy and choledochostomy. Patient much relieved immediately. Convalescence normal for eleven days, when he began to run a temperature between 99° and 101° F., which continued for two weeks. During this time there was a free discharge of necrotic fat and what appeared to be pancreatic tissue. Patient went home at the end of four weeks with a discharging sinus, which is still (June 15 1922) discharging a cloudy fluid.

Case IV—Ira G. Female aged thirty-eight. April 5 1922.

*Preoperative Diagnosis*—(1) Acute appendicitis. (2) Perforated viscus. (3) Acute cholecystitis.

*History*—Shortly after evening meal a sudden pain in back and right lumbar region. Soon all over abdomen. Severity has gradually increased. Vomited yesterday constant nausea. Bowels have not moved for three days.

*Physical Examination*—Fat woman, lying in bed with knees drawn up. In great distress. Dulness in flanks. General abdominal tenderness, especially marked in midline and to the right above umbilicus. No mass. Temperature 102° F. pulse 110. White blood-cells 10,000.

*Operation* (April 5 1922)—Free blood-tinged fluid in abdomen. Areas of fat necrosis, especially in gastrocolic omentum. Several large hemorrhagic areas and areas of necrosis in the pancreas. Necrotic areas punctured and the pancreas drained with cigarette wicks.

Gall-bladder thickened and contained bile and pus. Cholecystostomy. Temperature came gradually to normal eleven days after operation. pulse 90. On fifteenth day temperature rose to 103° F. and continued between 100° and 102° F. until fifty days after operation, when it dropped to 100° F. as its maximum, where it remained until her discharge sixty two days after operation. From the fifteenth day until her discharge there was a discharge of thin pus and necrotic material.

There was fat in the stools on four different days late in the course of the disease.

III. Symptoms.—Severe distress across the upper abdomen was the one constant symptom. Persistent nausea and frequent vomiting were present in 4 cases. Previous attacks of upper abdominal pain were present in 4 cases but as gall-stones were present in all it would seem to have little significance. It may be stated, however that among 22 cases of pancreatic necrosis without gall-stones, in 17 there had been one or more previous attacks of epigastric pain.

IV. Physical Examination.—All patients were rather obese. The abdomen was full and rounded, with some general tenderness but much more marked above the umbilicus. In 2 the diagnosis was made by the careful localization of tenderness above the umbilicus and extending from the gall-bladder region farther to the left than in most cases of cholecystitis. The diagnosis would have been made in 2 others if sufficient weight had been given to this finding. In the fifth the patient was too ill to determine the localization of tenderness.

The temperature was over 100° F. in only 2 cases. The pulse was over 100 in all cases.

The white count was over 12 000 in only 1 case.

Fluid was made out in the flanks in 3 cases and should have been determined in a fourth. There was obstipation in all but there was no evidence of active peristalsis and no fecal vomiting.

Fat was found in the stools in 1 case before operation, and in 2 cases several days after operation.

In none of these cases did the examining physician note the cyanotic appearance so frequently seen in these cases. In at least one it was present, I am sure after talking with the house officer who saw the case. The others were apparently not of sufficient severity to make this a prominent feature at least.

V. Treatment.—In all cases operated upon the pancreas and pancreatic capsule were drained through the gastrophatic omentum. In 3 others drainage of the biliary system was carried out. In 1 the ideal drainage was given that is, a cholecystectomy was done and the common duct drained for two weeks. In 2 there a cholecystostomy and drainage for two week

said to be pus in the gall-bladder but the other 2 gave no evidence of a recent infection. It is possible, however that there was sufficient infection to cause an infection of the pancreas, as suggested by Maugeret. It is strange however that simple drainage should have given an immediately normal temperature if the condition were due to an infection of the pancreas. In addition to that, cultures are practically never obtained from the pancreas.

In 4 the onset of the pain occurred very soon after a hearty meal. Brocq states that experimentally normal bile injected into the pancreatic duct during active digestion will cause a pancreatic necrosis.

**II. Preoperative Diagnosis.**—In 4 cases intestinal obstruction was seriously considered, and in 1 it was the diagnosis made by the majority of the men who saw the patient. These patients usually have an obstipation and frequently so marked that the diagnosis of intestinal obstruction is made. There is no evidence of hyperactive intestine to be seen or heard and usually a small amount of gas is obtained by enema.

Cholecystitis was the diagnosis made in 3 cases. It is difficult to rule this out especially when the patient has had previous attacks of epigastric pain. The only aid of value that we know in the differential diagnosis is the localization of tenderness which extends farther to the left in pancreatic necrosis than in cholecystitis.

Appendicitis was considered in 2 cases but the localization of tenderness should aid except in those too ill to localize it. The white count should be higher. Perforated gastric or duodenal ulcer was considered twice. It is difficult to differentiate this condition early. The tenderness should be much more extensive the liver dulness usually disappears and the white count is usually higher.

Ruptured gall bladder was considered twice. The gall bladder does not usually rupture until after quite a long period of distress and tenderness in the region of the gall-bladder. The tenderness and rigidity after rupture become general and the white count is high.

3. Archibald Surg. Gyn., and Obst., 1919 vol 28 p. 529
4. Judd and Mann Jour Amer Med. Assoc., July 16 1921
5. Deaver and Sweet Jour Amer Med. Assoc., July 16, 1921
6. Mangeret Recherches que la pathogene des pancreatites infectieuses
7. Graham Arch. of Surg. January 1922.
8. Whipple and Goodpasture Surg. Gyn., and Obst., 1913 vol. 17 p. 591
9. Graham Arch. of Surg. January 1921
10. Pierre Dufbet Bull. et Mens. de la Soc. de Chir. de Paris, 1914 p. 24.



The 1 case which did unusually well had only drainage of the pancreas and its capsule the treatment which Archibald says is theoretically wrong. He believes that drainage of the biliary system is sufficient. That drainage of the pancreas and its capsule is of immediate benefit to the patient was demonstrated in all 4 cases, which were immediately relieved of their symptoms, and there was a fall in pulse and temperature.

In only 1 case did the patient receive the proper treatment, if we follow Deaver and Sweet. They believe that the pancreatic necrosis is due to an infection from the gall-bladder and that the way to get rid of the infection is to remove the gall-bladder.

We believe that the most important part of the treatment in these cases is to drain the pancreas and pancreatic capsule. If the patient's condition permits, a cholecystostomy or choledochostomy and drainage should be done. Cholecystectomy and cutting of the sphincter of Oddi as suggested by Archibald, are too severe to carry out on most of these cases.

VI. Convalescence.—In all cases the patients were relieved of pain at once and showed marked improvement. In 3 the temperature fell to normal at once in 1 in ten days. In 1 the temperature did not rise again and convalescence was uneventful. This is very unusual except in the milder cases. In 3 the temperature rose between the eleventh and fifteenth days, when a discharge of thin pus and necrotic material appeared. This discharge lasted over a period of several months in 3 cases. In none of these cases was drainage through the left loin carried out as this has not proved very satisfactory with us.

A patient operated upon seven years ago has just returned to the hospital still wearing a tube from which there is a discharge of clear fluid possibly from a pancreatic cyst as we have been unable to prove that the fluid is pancreatic secretion. This patient for the first time shows sugar in his urine.

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## CLINIC OF DR. IRVING J. WALKER

BOSTON CITY HOSPITAL

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### POSTOPERATIVE OBSTRUCTION OF THE SMALL INTESTINE

INTESTINAL obstruction following laparotomy is a complication quite as much dreaded by surgeons as any postoperative untoward result. That there is just ground for this dread is undisputed since the mortality is high averaging about 30 per cent. The operative mortality naturally much lower in the early cases, runs as high as 60 per cent. in some of the later ones.

While surgery has advanced markedly as regards the treatment of most acute abdominal conditions, its progress in the treatment of acute ileus due to postoperative intestinal obstruction seems to have remained practically at a standstill for some years.

In analyzing the reasons for the high mortality we are brought face to face with the following facts. In many cases symptoms which of course mean little or nothing to the patient go on until they are so far advanced and the patient so desperately ill when seen by a surgeon that the only outcome is certain death.

Again a certain number of cases of obstruction occur postoperatively while the patient still in the hospital may be said to be directly under the eye of the surgeon. There is, of course no crime attached to this, though it seems unnecessary to say the least that such cases of acute obstruction occurring while under the care of a surgeon should be allowed to progress to the stage where the chance of recovery is very doubtful. In other words, a percentage of deaths due to intestinal obstruction may be charged up to the inability of the surgeon to recognize the condition in its early stages and take the necessary steps to remedy it.



way as do the early adhesions. It is a fact that adhesions form more frequently soon after operation than is generally appreciated. It is also true that such adhesions disappear or undergo changes becoming more and more thinned out as time goes on in most instances causing no trouble in the future. This is quite important as will be seen later when treatment of very early cases of acute postoperative obstruction is mentioned.

**Location of Adhesions.**—The offending adhesions, in a general way will be found in the region of the abdomen where the trauma and infection have been the greatest. The small gut is the part of the intestinal canal most commonly affected in cases of postoperative obstruction. Because of its location to frequent sources of infection and trauma the ileum becomes the most common site for offending adhesions to be found. Much experimental evidence has been produced to show reasons for death in acute obstruction of the small intestine. The practical conclusion of all such research may be summed up by stating that because of obstruction of the small intestine toxins are produced which when absorbed in sufficient quantities act rapidly upon various organs and glands, with the resulting death of the individual. Shock in whatever way it may be produced other than from absorption of intestinal contents, possibly plays a part in the fatal outcome of certain cases of intestinal obstruction.

**Symptoms of Acute Obstruction of the Small Intestine.**—Differential diagnosis of any obscure abdominal condition is always difficult and many times a clear-cut picture of an existing lesion cannot be made. This is especially true of acute obstruction of the small intestine. Such conditions as mesenteric thrombosis, ileus due to infection, postoperative dilatation of the stomach, acute pancreatitis, valvular obstruction due to new growth or gall-stones may in certain stages of their progress symptomatically resemble acute obstruction due to adhesions, and vice versa. Therefore to give any group of symptoms constantly typical of any one of the above lesions and attempt to differentiate them from those of acute obstruction due to adhesions would result in a most confused mental picture since the symptoms in all these conditions change from hour to hour. Obstruc-

Roughly speaking cases of acute postoperative obstruction can be divided into two classes—the first, those occurring a few days or weeks after operation—the second, those occurring months or years following laparotomy. Paralytic ileus due to infection, obstruction due to gall-stones or new growth, mesenteric thrombosis, and obstruction due to strangulated hernia, problems unto themselves, are not considered in this paper. Postoperative obstruction both early and late is due to the mechanical action of adhesions. The microscopic study of such adhesions differs in the early and late cases. Occasional obstruction may be caused by pressure from a pus-pocket or hematoma. Usually such a condition is easily recognized and quite as easily relieved. Factors which contribute to the formation of adhesions are infection, trauma at the time of operation, imperfect peritonization of raw areas and irritation as a result of drainage.

The early cases of obstruction occur from the third to the twentieth day after operation, usually about the fifth to the twelfth day. The process by which these adhesions form is somewhat as follows. After any operation, especially one where there has been a considerable amount of infection combined with some trauma and drainage there is always a local increase in the blood-supply to that region, with a corresponding increase in the exudate. By bulk the latter of itself may be sufficient to cause some mechanical pressure upon one or more loops of intestine. Some of the very early cases of obstruction are due to this.

The other cases in this group—those occurring from the fifth to the twentieth day—are due to definite bands or adhesions, revealing beginning organization with connective-tissue formation in the exudate. These, by an angulation of or by pressure upon loops of intestine may occlude the lumen of the latter producing the symptoms of obstruction. At operation these bands can be demonstrated to be easily separated by the slightest touch.

The late cases—occurring months or years after operation, are the end-results in the connective-tissue organization of the exudate produced after operation. These very dense usually can be divided only by cutting. Mechanically they act the same

way as do the early adhesions. It is a fact that adhesions form more frequently soon after operation than is generally appreciated. It is also true that such adhesions disappear or undergo changes becoming more and more thinned out as time goes on, in most instances causing no trouble in the future. This is quite important, as will be seen later when treatment of very early cases of acute postoperative obstruction is mentioned.

**Location of Adhesions.**—The offending adhesions in a general way will be found in the region of the abdomen where the trauma and infection have been the greatest. The small gut is the part of the intestinal canal most commonly affected in cases of postoperative obstruction. Because of its location to frequent sources of infection and trauma the ileum becomes the most common site for offending adhesions to be found. Much experimental evidence has been produced to show reasons for death in acute obstruction of the small intestine. The practical conclusion of all such research may be summed up by stating that because of obstruction of the small intestine toxins are produced which when absorbed in sufficient quantities act rapidly upon various organs and glands with the resulting death of the individual. Shock, in whatever way it may be produced other than from absorption of intestinal contents, possibly plays a part in the fatal outcome of certain cases of intestinal obstruction.

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tion of the small intestine due to adhesions does, however give a fairly definite trend of symptomatology. The previous history of each case the exact time of onset as noted by the first symptom and the trend of the latter from hour to hour in their progress, are comparatively more or less typical.

**Previous History**—This is especially important as regards previous operation, the nature of which should be carefully determined. The location of that lesion should bear considerable weight since obstruction is more likely to follow operation upon the appendix, or pelvic organs in the female than upon the stomach gall-bladder or other viscera high in the abdomen.

Again, the question of infection existent at the time of or following the previous operation should be carefully considered and its importance in the individual case weighed.

Trauma at the time of operation or irritation created during the convalescence by drainage should be considered as very important in causing possible existing adhesions.

Perhaps the most important factor in the causation of adhesions is faulty drainage. It is a well-known fact that too much drainage and faulty materials will produce adhesions where a small amount of other material is not likely to do so. Gauze for example, is quite certain to produce more irritation than such material as rubber tissue or Cargile membrane.

From the above one should be impressed by the importance of the history of previous operation. Finally one is brought face to face with the present condition of obstruction. The time of onset and the nature of the earlier symptoms are of the greatest importance. No smallest detail of the latter should be neglected, and the slightest observation as well as the pronounced changes in symptomatology will finally give a fairly clear picture of acute obstruction of the small intestine. If a few important observations be omitted or symptoms wrongly timed the picture entirely changes, causing a possible error in diagnosis.

The following is a rather typical case of acute obstruction occurring early after laparotomy

C. B. Age seven.

*Past History*—Negative

*Present Illness*—Three days ago taken with pain in the abdomen and vomiting the pain gradually increasing up to the present time.

*Operation*—Right rectus incision was made an appendix gangrenous and perforated near the tip was found an abscess was located between the cecum and the abdominal wall the appendix was removed, the stump inverted one cigarette drain was inserted to the pelvis, and another to the stump of the appendix.

Convalescence was practically uneventful up to the fifth day after operation. Temperature on the morning of this date was 98.6° F., pulse 90 In the afternoon the patient, unknown to the nurse was given some candy by the mother Shortly after ward the child vomited, continuing to do so Vomitus at first contained undigested food later there was nothing but water slightly bile stained. All fluids were stopped by mouth. There was no distention of the abdomen. The pulse had now risen to 120 the temperature remaining normal. There was no tender ness or spasm at any point in the abdomen. Vomitus became more bile stained and the stomach was washed out. There was some relief from vomiting for a short time then it recommenced. Vomitus was now yellowish in character evidently coming from the small intestine An enema was given about four hours after the vomiting started because there was slight distention. Some gas was passed Three hours later there was much more marked distention of the abdomen and an enema gave no results. Vomiting of intestinal contents continued. It was then decided that the child was suffering from obstruction of the bowels, probably in the region of the ileum. Jejunostomy was done under ether the child making an uneventful recovery without further operative measures, leaving the hospital on the eighteenth day.

The history and symptomatology in this case can be deemed fairly typical of most early cases of acute obstruction of the small intestine The salient feature is vomiting without known cause at first of stomach contents, later of bile stained fluid still later of yellow contents of the upper intestine If the case is allowed to progress the vomitus will become fecal in character Vomiting



In these cases cannot be controlled even though all fluids are withheld by mouth and the stomach repeatedly washed out. Abdominal pain, not at first a marked feature, does become greater with the increase of distention due to gas. The latter though it may be entirely absent at first, gradually becomes more and more marked. One should not be misled by the fact that the first enema may result in expulsion of some flatus. This is to be expected as it is the gas which has accumulated in the large bowel before the obstruction took place. Later enemata produce less and less gas, until finally none at all is expelled, even though the patient becomes more and more distended.

Palpation of the abdomen may elicit slight general tenderness but no spasm unless a local or general peritonitis exists. There is no elevation of temperature, as a rule and the respiration rate is not increased until the distention becomes marked. The pulse curve is fairly characteristic. Before the onset of the obstruction the pulse will be normal in rate unless there is some reason for its being otherwise. With the first symptom however which is vomiting there is a rise in the pulse, which gradually increases up to the point where the vomitus becomes fecal and the patient profoundly toxic. At this stage the pulse becomes very rapid, of poor quality and intermittent, and death soon ensues.

The prognosis in cases of acute obstruction of the small intestine naturally depends upon the duration of the obstruction. Mortality varies from 3 per cent. in very early cases to 100 per cent. in late cases not operated on. A large series of cases operated on showed mortality in the neighborhood of 30 to 60 per cent. Other factors being equal, at least 90 per cent. of the cases will recover if operated on during the first eight hours after the obstruction starts.

Treatment.—The chief fact to be remembered in all these cases is that the patients being in a very serious condition cannot stand extensive and prolonged operations. In other words, a measure must be chosen that will relieve the toxic condition with the least shock. I believe this to be jejunostomy preferably under a local anesthetic. In the greater number of cases no

operation for the relief of the adhesions should be done at the time of the acute obstruction. Even jejunostomy cannot be expected to save patients who are too profoundly toxic. It therefore behooves a surgeon to make an early diagnosis following it at once by jejunostomy.

**Jejunostomy**—It is desirable that the opening of the intestine be made as high as possible preferably in the jejunum. The operation is best done under novocain. In very young subjects, however where this is impractical a general anesthetic may have to be used. The incision should be in the midline above the umbilicus or in the left upper quadrant. Unless the patient is very obese it need not be over 2½ inches long. The abdomen being opened, the jejunum is identified by passing the finger upward under the transverse colon in search of the ligament of Treitz. If this is located the jejunum can easily be traced down and brought into the wound. If it is not easily located one should choose the loop of intestine that he thinks is highest in the tract. The selected loop of gut being held between two intestinal forceps two rows of purse-string sutures are passed. An opening is then made in the intestine large enough to admit a No 16 or No 18 French catheter. It is not necessary that this opening be larger. If it is, there is the danger of a resultant fistula from which there would be a loss of a large amount of intestinal contents. This is undesirable. Also a larger opening would take a longer time to heal. A self-retaining catheter is then inserted into the opening and the sutures tied. It is a good plan, where possible, to find the great omentum bring it into the wound, passing the free end of the catheter through an opening in this, so that the omentum lies around the catheter and over the loop of intestine. This is of great advantage when the catheter is removed as the omentum at that time falls over the opening very quickly sealing off the fistulous tract. A few interrupted catgut sutures are then placed uniting the intestine and the omentum to the parietal peritoneum. No further suturing of the incision is necessary or desirable.

With care one may keep the self retaining catheter in place a considerable period of time. It will then fall out or may be

removed by simply cutting off the bulbous end thus allowing this portion to drop into the intestine, where it is carried along the intestinal canal and finally passed. If the ordinary catheter be used it will be found to remain in place about six days at which time it will begin to loosen and eventually fall out. The leakage which follows removal of the catheter may result in some irritation of the abdominal wall due to gastric and pancreatic secretions. Frequent dressing and irrigation of the wound, combined with the use of a preparation of compound tincture of benzoin and zinc oxid ointment on the skin, will usually keep the irritation of the latter at a minimum. If the great omentum is utilized to surround the catheter leakage after the latter is removed will be of only a few days duration. Where the omentum is not used leakage will persist from six days to four months. The average time for a fistula to drain is three weeks. In but 1 of 28 cases that recovered following jejunostomy done for various conditions, including intestinal obstruction, was it necessary to close the fistula by suture. In this case I believe it would have closed spontaneously had we delayed operation a short time.

One of the advantages of jejunostomy in addition to the fact that it relieves intestinal gas and toxic material, is that it can be used for the administration of nutrition, drugs, and fluids where such cannot be given by mouth.

Several days after jejunostomy when the patient has recovered from the toxic condition, the attention of the surgeon can be directed to the consideration of the obstruction itself. Here the procedure differs in cases of obstruction following shortly after operation from those occurring months or years after. The difference will be found due to the histologic nature of the two forms of adhesions. Those occurring in the early cases of obstruction may be classed as acute inflammatory tissue showing microscopic characteristics of this condition. When jejunostomy is done in these cases and the contents of the bowels diverted from the area of obstruction, the acute inflammation in this neighborhood will gradually subside the obstruction in most instances relieving itself without need of further operative interference. Jejunostomy is far safer for these patients, generally

so desperately ill, than any operation for the separation of adhesions. In 16 cases where jejunostomy was done for the relief of obstruction, which had occurred five to fourteen days after operation, all, without further operative measures recovered. It is a possibility that later on a certain number of these cases will develop acute obstruction due to organized bands or adhesions.

In the cases of acute obstruction occurring months or years after an abdominal operation one should remember that he is here dealing with a definite well-organized connective-tissue formation of bands or adhesions. Jejunostomy while relieving the symptoms due to obstruction, can have no effect on the dense adhesions. In these cases, after the symptoms of obstruction have subsided and when the patient is a good operative risk a laparotomy should be done and the offending bands divided. By the use of jejunostomy the present high mortality in cases of acute obstruction of the small bowel by bands and adhesions can be considerably lowered.



